ENGINEERING NEWS-RECORD

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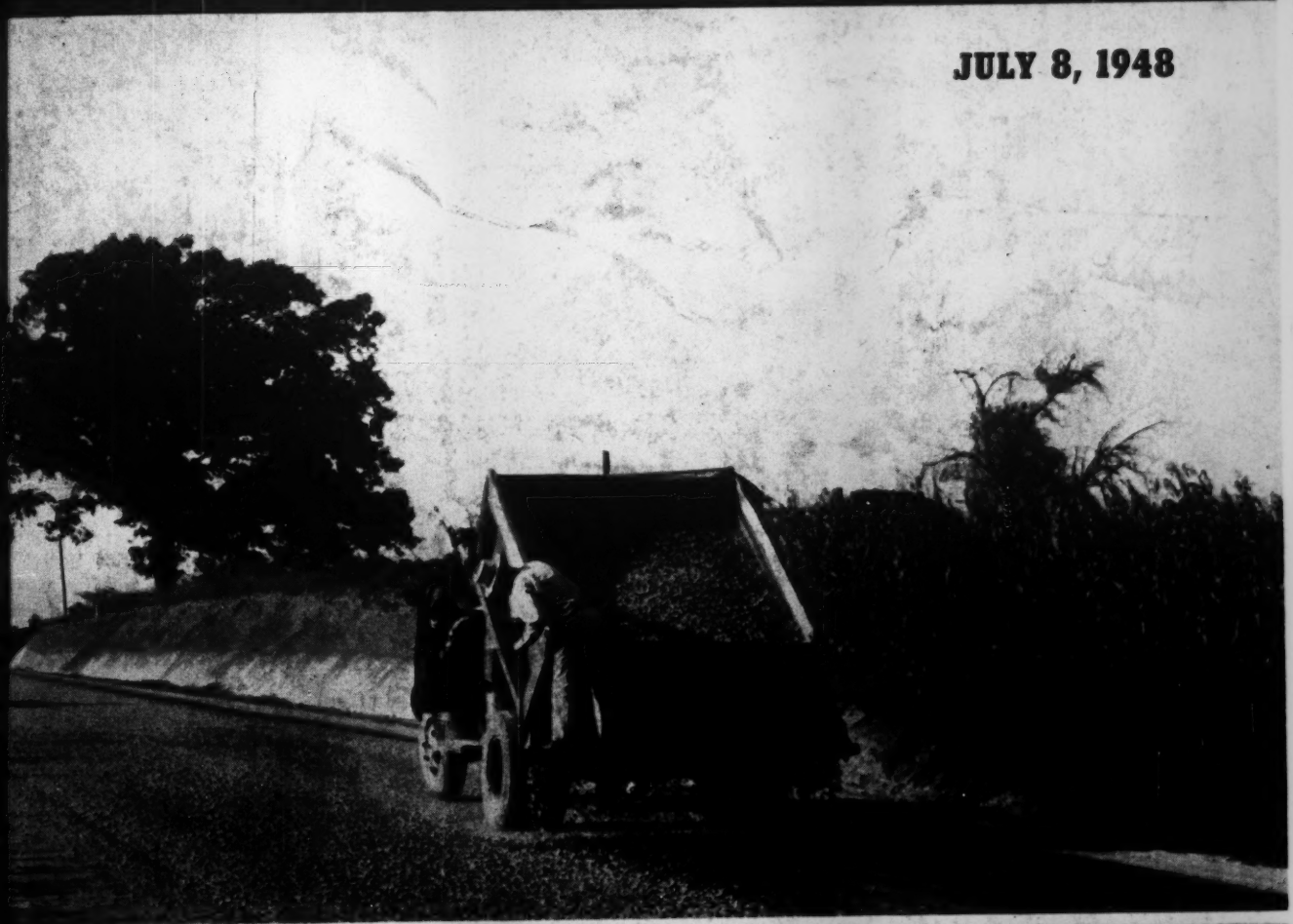

JULY 8, 1948

Including a Special Section previewing

THE ROAD SHOW

NEW YORK barge canal lock walls are armor plated with BYERS WROUGHT IRON

There's an interesting story behind the recent refacing job on the north wall of Lock 24 of the Erie Division, New York State Barge Canal System, at Baldwinsville.

In the winter of 1935-36, the south wall of this lock was scheduled for repair. The concrete had disintegrated—not deeply, but in a way that left the face extremely rough. About 5" of depth was removed, and ½" wrought iron plates installed. Bolts and cinch anchors were used, to bring the face of the plates out to the plane of the original wall. New concrete was then poured to back-fill the space.

During the past winter the north wall demanded repair. Inspection of the 12-year-old wrought iron facing on the south wall showed no damage to plates, no sign of loosened plates, and no evidence of progressive oxidation. Wrought iron was selected for the current repair. Since disintegration of the concrete had been more excessive, about 12" of depth was removed, and the wrought iron plates installed as before.

It might be added that during the winter of 1941-42, both walls of Erie Lock 24, located about three miles west of Brewerton, N.Y., were refaced with ¼" wrought iron plates. The thinner plates were somewhat more difficult to install, but are reported satisfactory in service.

Wrought iron is a veteran in applications like this. The unusual corrosion-resistance that has led to its wide-spread use is the result of the special character of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack. They also help anchor the initial protective film, which shields the underlying metal.

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CORROSION COSTS YOU MORE THAN WROUGHT IRON

ENGINEERING NEWS-RECORD

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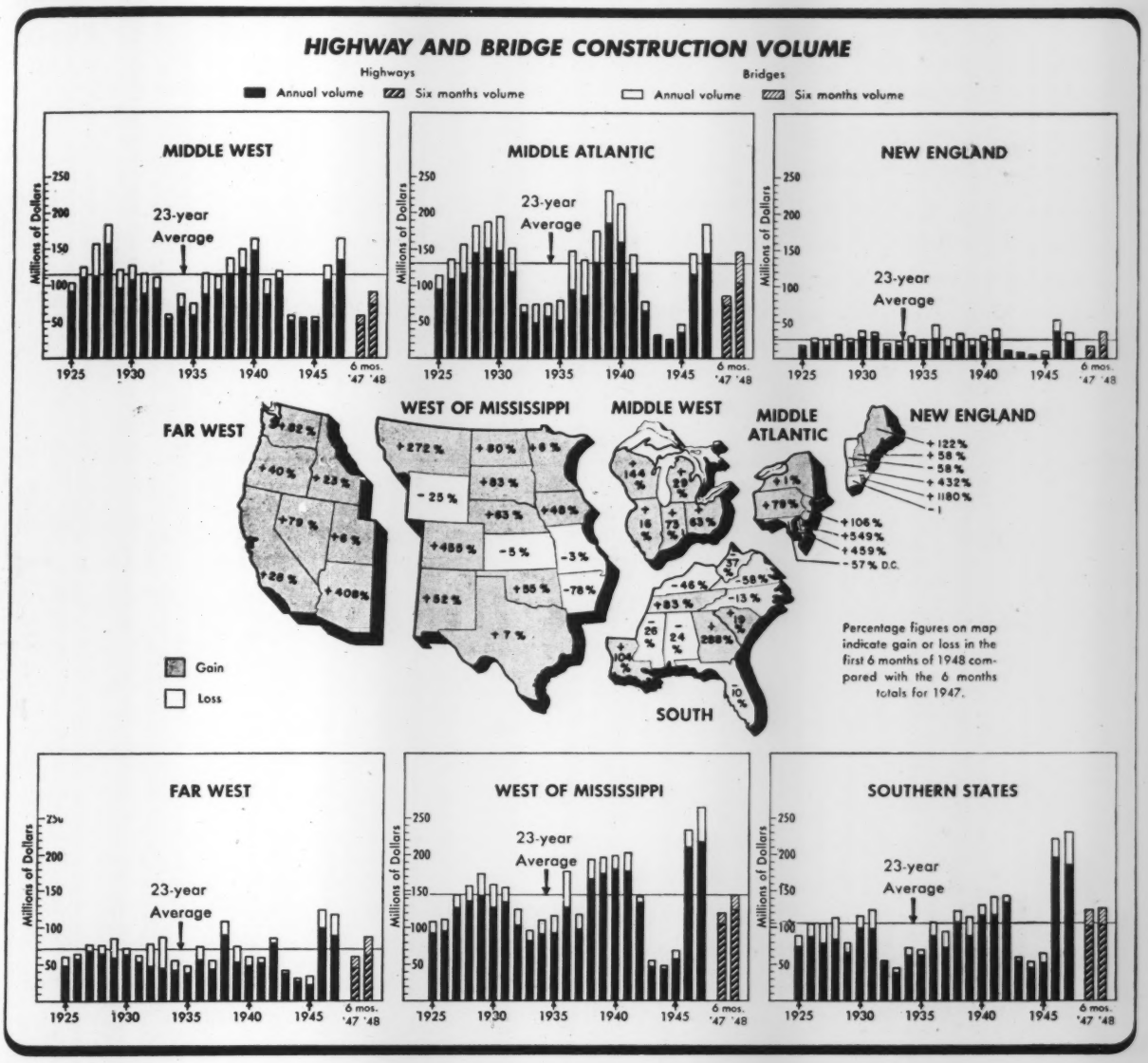
CONSTRUCTION TRENDS



Highway and Bridge Construction Rises 36% Above 1947

Highway and bridge construction volume, rising to $625,422,000 in the first six months of 1948, is 36 percent above the corresponding period a year ago and 48 percent above the 1946 six months total, according to contract awards reported by *Engineering News-Record*.

All six sections of the United States showed gains in 1948 over the 1947 volume, with 35 individual states recording gains. New England made the greatest gain, rising 121 percent. Middle Atlantic rose 73 percent; Middle West, 56 percent; Far West, 44 percent; West of the Mississippi, 19 percent; and the South, 2 percent.

Of the 13 states showing declines, ranging from 1 percent in Connecticut to 78 percent in Arkansas, seven are located in the South, four in the section West of the Mississippi and two in New England. All the Far West, Middle West and Middle Atlantic States showed gains over the first six months of 1947, with the exception of the District of Columbia where highway and bridge construction volume this year declined 58 percent below a year ago.

Highway and bridge construction volume so far this year is over double the corresponding six months totals in twelve states. Rhode Island showed a gain of 1180 percent; Delaware, 549 percent; Massachusetts, Maryland, Colorado and Arizona, over 400 percent; Georgia and Montana, approximately 275 percent; and Wisconsin, Maine, New Jersey and Louisiana increased between 100 and 150 percent.

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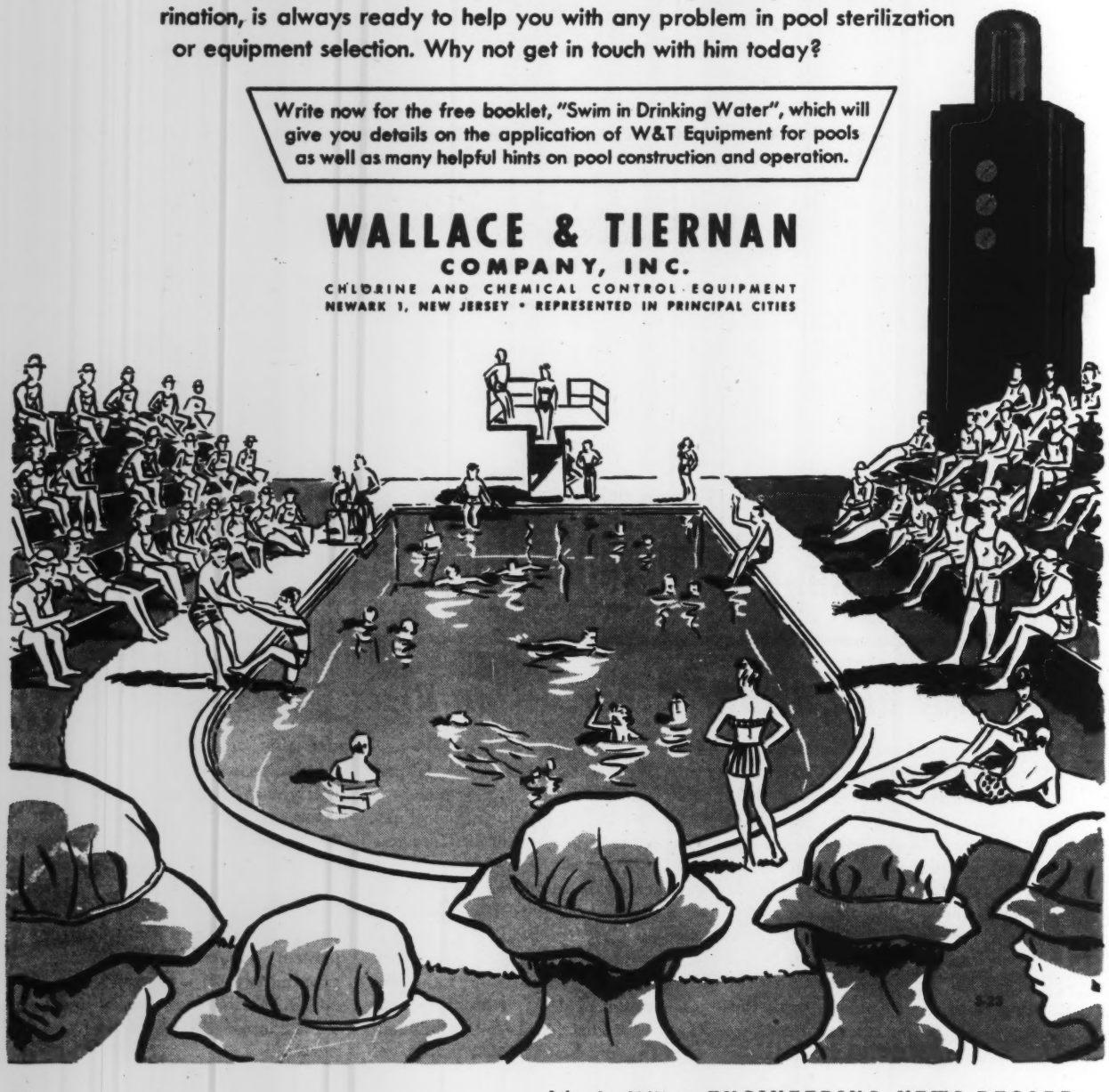
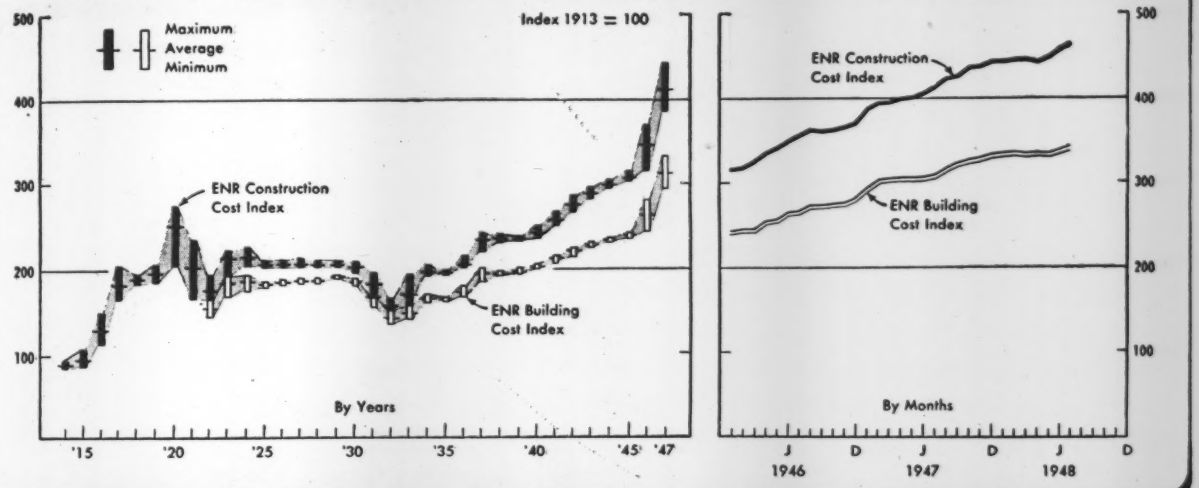


JULY CONSTRUCTION BUSINESS REPORT

ENGINEERING NEWS-RECORD CONSTRUCTION AND BUILDING COST INDEX TRENDS



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	June 1947 (4 wk.)	June 1948 (4 wk.)	% Change	Six Months 1947 (26 wk.)	Six Months 1948 (26 wk.)	% Change
Total U. S. Construction	$517,175	$596,332	+15	$2,673,865	$3,333,369	+25
Private Construction	251,999	330,830	+31	1,542,435	1,624,370	+5
Public Construction	265,266	265,502	+0.01	1,131,430	1,708,999	+51
Federal	105,821	58,247	−45	331,938	527,163	+59
E N R Construction Volume Index, 1913 = 100	274	282	+3	224	249	+11
Total New Productive Capital	$197,677	$631,596	+220	$889,245	$2,180,118	+145
Private Investment	197,677	631,596	+220	889,245	2,180,118	+145
Federal (non-federal work)	.....	.....	.....	.....	.....	.....
Federal (federal work)	.....	.....	.....	.....	.....	.....

CONSTRUCTION COSTS . . . WAGE RATES . . . MATERIAL PRICES

1913 = 100	July 1947	July 1948	% Change	Change June to July 1947 June	1947 July	%	Change June to July 1948 June	1948 July	%
E N R Constr. Cost Index†	413.75	463.23	+11.96	406.63	413.75	+1.75	455.80	463.23	+1.63
E N R Building Cost Index†	308.90	342.42	+10.85	307.42	308.90	+0.48	339.26	342.42	+0.93

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

	July 1947	July 1948	% Change	June 1947	July 1947	%	June 1948	July 1948	%
Common Labor	$1.233	$1.386	+12.41	$1.185	$1.233	+4.05	$1.352	$1.386	+2.51
Skilled Labor (Av. 3 Trades)	2.073	2.287	+10.32	2.015	2.073	+2.88	2.250	2.287	+1.64
Bricklayers	2.215	2.456	+10.88	2.175	2.215	+1.84	2.406	2.456	+2.08
Structural Ironworkers	2.067	2.290	+10.79	2.004	2.067	+3.14	2.268	2.290	+0.97
Carpenters	1.938	2.114	+9.08	1.867	1.938	+3.80	2.075	2.114	+1.88
Cement, bulk, per barrel	2.53	2.82	+11.46	2.51	2.53	+0.80	2.82	2.82	0.0
Structural Steel, base	2.50	2.75	+10.00	2.50	2.50	0.0	2.75	2.75	0.0
Sand, per ton	1.782	1.960	+9.99	1.777	1.782	+0.28	1.958	1.960	+0.10
Lumber, 2x4 Fir, per M ft.	86.29	97.28	+12.74	87.53	86.29	−1.42	96.93	97.28	+0.36
Lumber, 2x4 Pine, per M ft.	77.31	88.41	+14.36	80.67	77.31	−4.17	88.91	88.41	−0.56
Common brick, per M	22.850	25.850	+13.13	22.850	22.850	0.0	25.700	25.850	+0.58
Ready-mixed concrete, c.y.	8.934	9.995	+11.88	8.934	8.934	0.0	9.951	9.995	+0.44
Struct. clay tile, 3x12x12	118.41	124.03	+4.75	118.41	118.41	0.0	123.13	124.03	+0.73

* *Revised.*

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	June 1947	June 1948	% Change	May 1948	% Change May to June
Steel (% Operating Capacity) A.I.S.I., weekly average	96.3	96.1	−0.2	94.4	+1.8

	April 1947	April 1948	% Change	Four Months 1947	Four Months 1948	% Change
Cement, thous. bbl. U.S.B of Mines	15,414	16,041	+4.1	44,376	47,541	+7.1

	May 1947	May 1948	% Change	Five Months 1947	Five Months 1948	% Change
Fabricated Structural Steel, tons, A.I.S.C.	154,980	168,522	+8.7	726,947	785,816	+8.1
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$215,336	$353,040	+63.9	$1,002,203	$1,578,384	+57.5

COST OF LIVING INDEX . . . . EMPLOYMENT

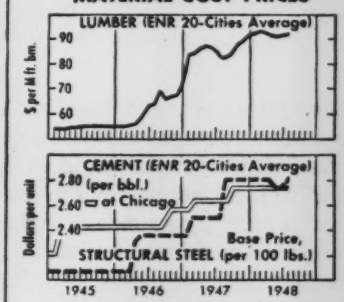
Base 1935–39 = 100	1941	May 1947	May 1948	% Change	April 1948	% Change April to May
Consumers' Price Index, B L S	105.2	155.8	170.5	+9.4	169.3	+0.7
Rent (Housing) Index, B L S	106.2	109.2	116.5	+6.7	116.3	+0.2

	May 1947	May 1948	% Change	April 1948	% Change April to May
Contract Constr. Employ. (est.), thous., B L S	1,685	2,064	+22.5	1,966	+5.0

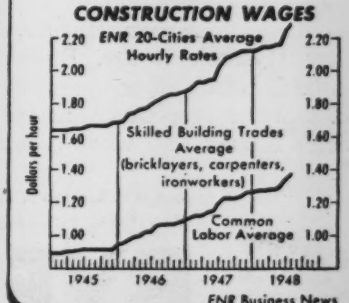
ENR INDEX NUMBERS

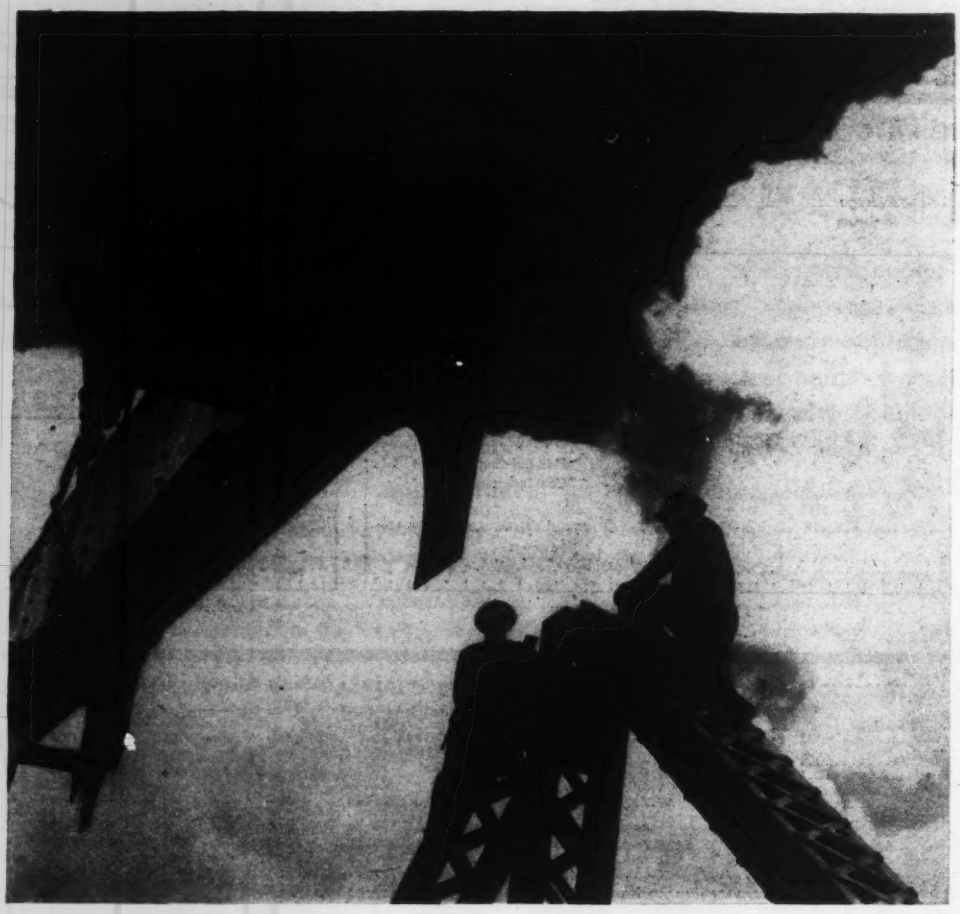
Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
July, 1948	463.23	222.67	342.42	185.10	...	...
June, 1948	455.80	219.10	339.26	183.39	282	124
May, 1948	447.86	215.29	333.93	180.51	258	113
Apr., 1948	443.64	213.26	334.56	180.85	302	132
Mar., 1948	443.60	213.24	334.22	180.67	247	108
Feb., 1948	442.67	212.79	335.49	181.36	231	101
Jan., 1948	441.65	212.30	333.58	180.32	173	76
Dec., 1947	441.13	212.05	333.06	180.04	246	108
Nov., 1947	436.91	210.02	329.22	177.97	234	103
Oct., 1947	434.58	208.90	327.29	176.92	228	100
Sept., 1947	426.38	204.96	322.58	174.38	250	110
Aug., 1947	422.85	203.26	317.75	171.77	211	93
July, 1947	413.75	198.89	308.90	166.98	218	96
June, 1947	406.63	195.47	307.42	166.18	274	120
1947 (Av.)	413.16	198.61	312.96	169.18	228	100
1946 (Av.)	346.04	166.34	262.35	141.82	248	109
1945 (Av.)	307.75	147.93	239.14	129.27	123	54
1944 (Av.)	298.72	143.59	234.73	126.89	96	42

MATERIAL COST PRICES



CONSTRUCTION WAGES





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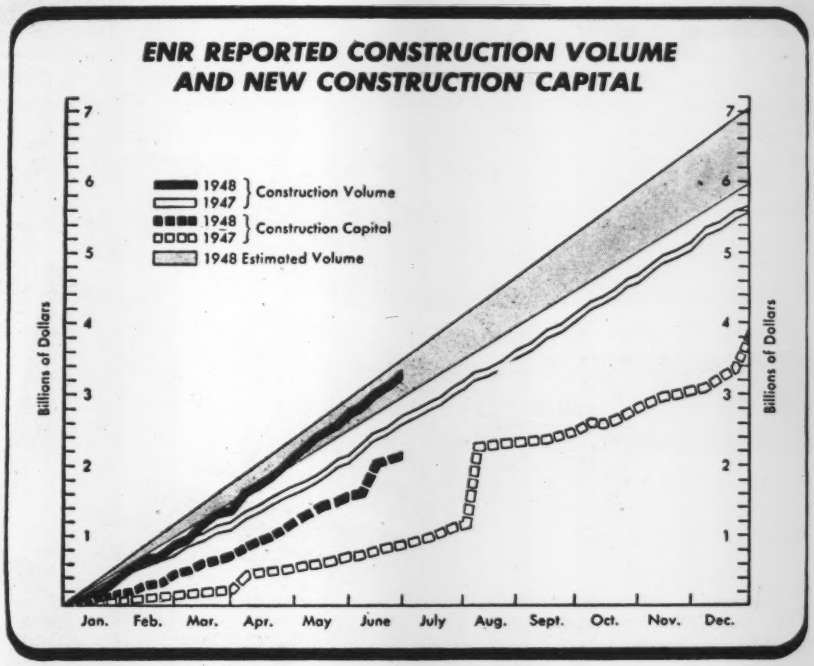
RYERSON STEEL

New Construction Volume in June



Civil engineering construction volume in continental United States totals $596,332,000 for June, an average of $149,083,000 for each of the four weeks of the month. This total is 11 percent above that for May, 1948 and 15 percent above the June, 1947 total, according to *Engineering News-Record*.

Private construction for June is 34 percent above last month and 31 percent above June 1947. Public construction is 8 percent below last month and .09 percent above last June. State and municipal construction is 7 percent below last month but 30 percent above the total for June, 1947. Federal construction, down 10 percent from last month, is 45 percent below June, 1947.

The various classes of construction for June, 1948 compared with May, 1948 show gains in private unclassified of 449 percent; total public and private bridges, 91 percent, industrial buildings, 62 percent; sewerage, 29 percent; public unclassified, 16 percent; public buildings, 2 percent; and commercial buildings, 1 percent. Losses are recorded for highways of 6 percent, earthwork and drainage of 20 percent, and waterways of 83 percent.

Geographically, the Middle West showed a gain in June, 1948 over May, 1948 of 63 percent; West of the Mississippi, a gain of 60 percent; the South, a gain of 20 percent; and the Far West, a gain of 12 percent. Losses were shown in New England of 14 percent and Middle Atlantic of 27 percent.

Five sections made gains in June over June, 1947—New England, 70 percent; Middle West, 32 percent; West of the Mississippi, 31 percent; Far West, 27 percent; and Middle Atlantic, 10 percent. A loss of 21 percent was shown in the Southern section.

New capital for construction for the four weeks of June, 1948 totals $631,596,000, or a weekly average of $157,899,000 for the month. The weekly average is thus 95 percent above the weekly average of $81,024,000 for May, 1948 and 220 percent above the weekly average of $49,419,000 for June, 1947.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—JUNE, 1948

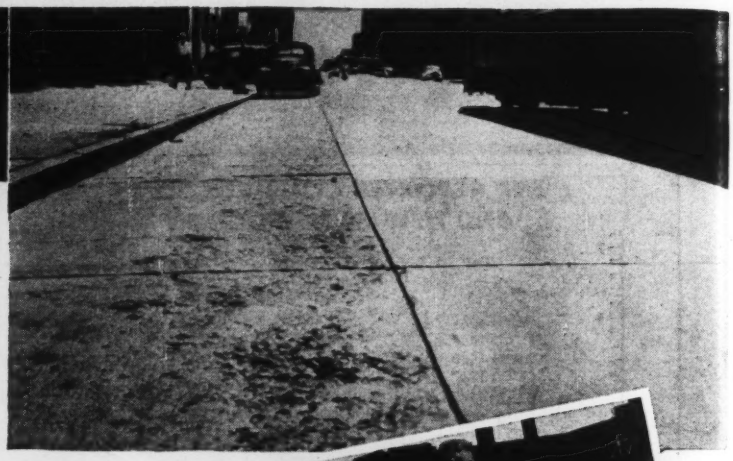
Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—Waterworks, excavation, drainage and irrigation,* $28,000; *other public works* $50,000; *industrial buildings,* $68,000; *other buildings,* $250,000

Four Weeks—Thousands of Dollars (000 Omitted)

							United States			
							June	Six Months		
Public Works	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	1948	1948	1947	Canada
Waterworks	.....	1,311	1,565	867	2,015	494	6,252	98,463	55,627	575
Sewerage	510	215	4,592	3,821	1,966	4,571	15,675	102,757	64,171	244
Bridges, public	906	16,737	2,741	3,327	3,432	4,209	31,352	143,676	81,102	65
Earthwork and waterways	.....	7,584	531	948	15,130	3,123	27,316	272,450	156,940	524
Streets and roads	4,468	15,095	23,175	18,887	20,893	11,729	94,247	479,584	378,185	5,429
Buildings, public	6,794	17,540	16,432	4,916	21,742	9,591	77,015	509,416	252,419	10,538
Unclassified, public	98	2,467	1,845	694	2,096	6,445	13,645	102,653	142,986	1,837
Total public	12,776	60,949	50,881	33,460	67,274	40,162	265,502	1,708,999	1,131,430	19,212
Federal government (included in above classifications)	799	7,487	11,530	1,493	27,905	9,033	58,247	527,163	331,938	.....
Private										
Bridges, private	.....	660	334	.....	368	.....	1,362	2,162	684	.....
Industrial buildings	266	41,118	4,989	34,431	35,038	4,491	120,333	521,164	388,629	2,365
Commercial buildings	7,425	43,577	18,381	9,887	37,894	48,142	165,306	964,661	912,168	3,967
Unclassified, private	282	380	9,040	3,775	29,180	1,172	43,829	136,383	240,954	14,250
Total private	7,973	85,735	32,744	48,093	102,480	53,805	330,830	1,624,370	1,542,435	20,572
Total Engineering Construction:										
June, 1948 — 4 weeks	20,749	146,684	83,625	81,553	169,754	93,967	596,332	.....	.....	39,784
May, 1948 — 4 weeks	24,126	201,847	69,616	50,089	105,867	83,639	535,184	.....	.....	34,012
June, 1947 — 4 weeks	12,208	132,926	106,495	61,770	130,023	73,753	517,175	.....	.....	45,346
Six months — 1948	148,184	950,196	552,104	378,102	824,590	480,193	.....	3,333,369	.....	191,167
Six months — 1947	104,469	666,632	467,309	352,514	616,743	466,198	.....	.....	2,673,865	218,616

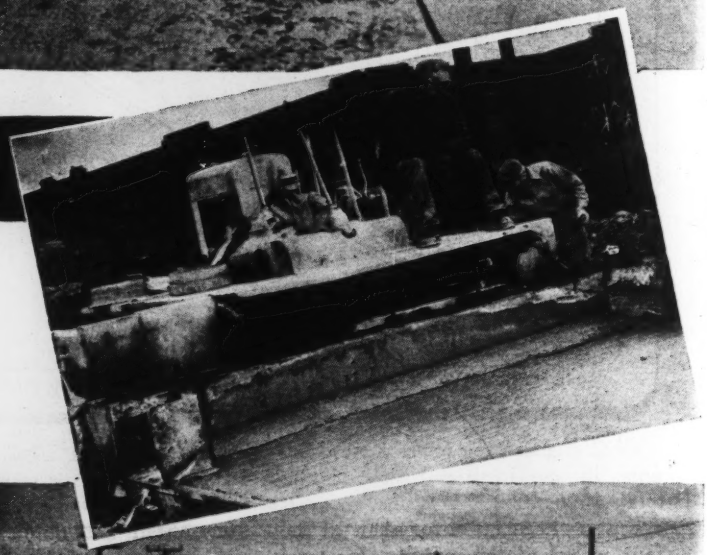
DURAPLASTIC

Concrete is more durable



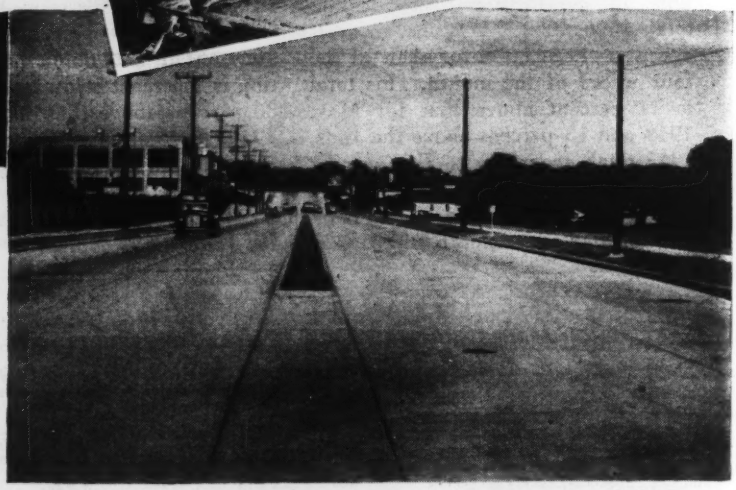
Concrete made with Duraplastic air-entraining cement resists the effects of freezing and thawing weather—is fortified against the scaling action of deicing salts. Picture shows two lanes, both four winters old. Note the difference between badly scaled surface of left lane (made with regular portland cement) and scale-free right lane (made with Duraplastic).

Easier to place...



Duraplastic has the proper amount of air-entraining material interground with the cement needed for satisfactory field performance. It requires less mixing water for a given slump. It makes a smoother, more plastic, more cohesive mix that spreads, screeds and finishes easier. Segregation and bleeding are minimized.

Sells at the same price as regular cement



Duraplastic air-entraining portland cement makes better concrete at no extra cost. It calls for no additional materials —merely the same care and good workmanship regularly employed.

DURAPLASTIC complies with ASTM and Federal specifications. Write for further information to Universal Atlas Cement Company (United States Steel Corporation Subsidiary,) Chrysler Building, New York 17, N. Y.

OFFICES: Albany, Birmingham, Boston, Chicago, Cleveland, Dayton, Des Moines, Duluth, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.

ENR-D-69

ATLAS DURAPLASTIC

AIR-ENTRAINING PORTLAND CEMENT

MAKES BETTER CONCRETE AT NO EXTRA COST

A UNIVERSAL ATLAS PRODUCT

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—September to June—ABC Network*

News of the Week

ENGINEERING NEWS-RECORD • JULY 8, 1948 • VOLUME 141 • NUMBER 2

Truman protests, but signs controversial legislation

President approves Interior, government corporation, housing bills, but scores Congress for poor work—Sees attack on U. S. power policy

Protesting that he was signing the measures virtually under duress, President Harry S. Truman last week affixed his signature to three controversial measures affecting construction.

The President accompanied each signature with a scathing denunciation of Congressional actions and motives in passing the disputed laws.

Included in the group of bills made law by Truman's signature—just barely within the deadline for his approval—were appropriations bills for the Department of the Interior, government corporations, and a much criticized housing bill.

Scores Interior "rider"

Frankly displeased with the legislation, Mr. Truman accompanied his signature of the Interior bill with a statement denouncing the rider attached to it, aimed at high officials of the Bureau of Reclamation. He said flatly that the bill would have been vetoed had Congress continued in session, but that he could not do so now because such action would have cut off all bureau funds as of July 1.

Funds included for the bureau in the measure are the greatest in its 46-year history—$251,541,139.

The commissioner, Michael Straus—a Truman appointee—and Richard L. Boke, California regional director, will be ousted because the rider on the appropriation bill specifies that no salaries shall be paid "to a commissioner of reclamation or a regional director" who is not a civil engineer with specified engineering experience and administrative background. Mr. Straus is a former newspaperman, and Mr. Boke is also a non-engineer.

Protesting that he "had no choice" in signing the measure, Mr. Truman pointed out that a veto would have forced the Interior department to halt all its work after July 1, since Congress had adjourned and no further action would have been possible. His statement concerning his action follows in part:

"If it had been possible to veto this bill without bringing the vital work of the department to a standstill, I would have done so because of a rider in the bill establishing arbitrary qualifications for the commissioner, the assistant commissioners, and the regional directors of the bureau of reclamation.

"This rider is designed to effect the removal of two men now holding such positions who have supported the public power policy of the government and the 160-acre law which assures that western lands, reclaimed at public expense, shall be used for the development of family-size farms. No matter what may be the asserted reasons for wanting to remove these men from office, the result would be to serve the purposes of special interests desirous of monopolizing the rich farm lands of the West and intent upon stopping the construction of transmission lines for the delivery of power from federal dams. These same interests tried first to get the law changed but failed, and having failed then sought to get the management changed.

"In addition to this attack upon the management of the bureau of reclamation, the act will delay important reclamation work in all of the great basin areas of the West, including the Missouri Basin, the Columbia Basin in the Pacific Northwest, the Central Valley in California, and the Colorado Basin.

"The act makes available $69 million less than I requested to carry on the vital work of the department.

"By specific provisions in the act and by statements in the committee reports accompanying its passage, the Congress has also made a broad attack on the national public power policy.

(*Continued on p.* 103)

U. S. Army Corps of Engineers

WHITE WATER—Under tremendous pressure, water shoots through discharge valves during tests at Mud Mountain Dam on the White River near Seattle, Wash. The dam itself, highest combination earthfill-rockfill structure in the world, was completed in 1942 by the Guy F. Atkinson Co., but positive control of floodwaters was impossible during the war because of lack of the 96-in. regulating valves of which there are three on 8 ft. dia. pipes.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public Construction—*Buffalo, N. Y.* will float a $400,000 bond issue to match a federal allocation for an $800,000 improvement program at Buffalo Airport subject to formal approval by the CAA . . . *Houston, Tex.* has asked for bids on a new wharf estimated to cost more than $1,000,000 . . . Marian College at *Indianapolis, Ind.* is spending $1,500,000 on construction of a residence hall and gymnasium and will also complete a $1,000,000 arts and sciences building later . . . Joint plans will be drawn by Land and Raugland and McEnary and Krafft for a $4,000,000 library in *Minneapolis, Minn.* . . . Canada's Department of Public Works has approved $3,330,000 construction of public buildings in *Ottawa, Ont.* . . . A contract has been awarded by the Mississippi River Commission at *Vicksburg, Miss.*, for a $256,000 office and concrete testing laboratory.

Industrial Construction—Mississippi Power Co. plans construction of a $4,000,000 steam-electric generating station in Lauderdale County near *Meridian, Miss.* . . . The first concrete was placed for the Portland Cement Association's new research and development laboratory at *Skokie, Ill.*, on June 30. . . . The American Smelting and Refining Co. has announced plans to build a $6,800,000 acid plant at *Garfield, Utah.* . . . A 14-story, $3,000,000 Employers Insurance Building is scheduled for immediate construction in *Dallas, Tex.* . . . The Lincoln Electric Co. at *Cleveland, Ohio*, plans construction of a $10,000,000 manufacturing plant which ultimately will provide 25 acres of floor space under one roof. . . . A new multi-million dollar chemical plant for the manufacture of silicone materials has been completed in *Waterford, N. Y.*, by the General Electric Co.

Labor—A 17-cent wage increase has settled the 10-week-old strike of *Elmira, N. Y.*, electricians. . . . The city council of *Houston, Tex.*, has voted to increase the minimum wage rates for all municipal construction projects. . . . Seven classes of skilled workers are affected by wage increases of from 7 to 14 cents per hour in *Halifax, N. S.*

Water Supply and Sewers—A break in the principal, 30-inch water main in *Dallas, Tex.*, was repaired by a 10-man crew in 12 hours. . . . A $550,000 bond issue was recently approved in *Palo Alto, Calif.*, for improvement of its municipal water, gas, and electric systems and for other city construction. . . .*Billings, Mont.* has awarded a contract for 8,731 ft. of additional trunk sewer lines in the city's $700,000 sewer improvement program.

Housing—Manchester Gardens, a $1,000,000 housing development in *Los Angeles, Calif.*, is under construction and will provide 140 rental units . . . *Spartanburg, S. C.*, is starting work on 106 five-room units to cost $750,000. . . . Carver Village, said to be the largest Negro housing development in the South, has been dedicated in *Savannah, Ga.* . . . A 200-home development known as Greenway Homes has been planned and completed in *River Edge, N. J.* . . . A housing development in *Hartford, Conn.*, is under way to provide 166 family-rental units at an estimated cost of $1,660,000 . . . *Englewood, N. J.*, plans a $2,000,000 garden apartment development to contain 142 dwelling units.

Recommend bridge for Chesapeake Bay crossing

Because of its lower initial cost, lower maintenance and operation costs, shorter construction period and other advantages, a bridge rather than a tunnel has been recommended to cross Chesapeake Bay. (*ENR* March 25, vol. p. 465).

The Highway Advisory Council of Maryland and the State Roads Commission recently unanimously recommended construction of the bridge. Action of the commission and the council was taken at a joint meeting with representatives of the commission's engineering staff and the J. E. Greiner, Co., consulting engineers.

Comparative bridge and tunnel data presented showed the estimated cost of the bridge project, exclusive of interest during construction and other financing costs, would be $35,000,000 as against $44,430,000 for the tunnel crossing.

Estimated annual costs of maintaining and operating the bridge, including operating personnel and expenses, insurance and bonds, reserves, maintenance and contingencies, would be $220,000 in comparison with $286,000 for the tunnel.

Army plans Columbia River control

Under a plan drawn up in the Portland district office, U. S. Army Corps of Engineers, flood waters of the Columbia River would be contralled to the extent that such disasters as that which has just visited the Pacific Northwest would be impossible.

The proposal, still in the dream stage, includes construction of eight major projects, supplemented by an extensive levee system. The projects involve dam construction on tributaries to the Columbia that would represent storage capacity of 20,000,000 acre-ft. of water. Adequate protection by reservoirs alone on the main stem of the Columbia is not economically feasible, the Army report says, because of the immense volume and long duration of the floods and the number of tributaries which would have to be controlled.

The engineers list the following dams:

Paradise Dam in western Montana. Storage capacity, 4,080,000 cre-ft. Estimated cost, $230,707,000.

Hells Canyon Dam, on Snake River between Idaho and Oregon. Storage capacity, 3,280,00 acre-ft. Estimated cost, $332,747,000.

Glacier View Dam on north fork of Flathead River in Western Montana. Storage capacity, 3,160,000 acre-ft. Estimated cost, $99,080,000.

Alberni Falls Dam, on Pend Oreille River in North Idaho. Storage capacity, 1,140,000 acre-ft. Cost $31,070,000.

Kootenai River Dam at Libby, Mont. Storage capacity 4,250,000 acre-ft. No estimate on cost.

Palisades Dam on upper Snake River in Idaho. Storage capacity, 1,200,000 acre-ft. (This dam has been authorized for construction by the U. S. Bureau of Reclamation.)

Priest River Rapids Dam on Columbia River above McNary dam. Storage capacity, 2,200,000 acre-ft. Cost not estimated. (This proposed dam is one of a chain included in Army engineer plans for eventual development of the Columbia River. Others are The Dalles, John Day, and Rock Island.)

Kooskia Dam on Clearwater River, tributary of the Snake, in Idaho. Storage capacity, 3,100,000 acre-ft. Cost not estimated.

While giving assurance that the U. S. Army Engineers will repair damaged portions of levees in Columbia River flood areas, Col. Theron B. Weaver, North Pacific division engineer, has informed drainage district officers that full basic responsibility for operation and maintenance of flood control facilities rests with the districts.

Army engineers to spend $1.2 billion on construction in U. S. and abroad

Huge twelve-month program seen influencing Gen. Wheeler's decision to remain as Chief of Engineers

The Corps of Engineers in the next twelve months will expend $1,000,000,000 entirely under the direction of the Chief of Engineers, and another $200,000,000 will be expended by the engineer officers attached to the various armies.

Beyond these sums, the Corps of Engineers will direct and supervise construction running into hundred of millions for other agencies of the federal government.

This huge program was a factor in Lt. Gen. R. A. Wheeler's decision to accede to the request of Army Secretary Kenneth C. Royall that he remain in his post as Chief of Engineers for another year (*ENR* July 1, p. 10). He will not reach the statutory retirement age until July 31, 1949.

For fiscal 1949, General Wheeler said last week, the corps will have the largest civil works program in its history—a total of $580,664,150. In this amount are $411,750,000 for flood control and $167,000,000 for rivers and harbors.

New construction will receive $462,961,200 of this total—$325,908,100 for general flood control, $47,000,000 for the Lower Mississippi, $1,565,000 for the Sacramento River, and $88,488,100 for rivers and harbors.

New military construction by Army engineers in the U. S. and overseas during the fiscal year will come to $183,700,000.

A decentralized organization of skilled, experienced personnel makes it possible to handle a program of these overall dimensions efficiently, General Wheeler explained. The organization is broken down into 46 districts, each headed by a district engineer to whom the Chief of Engineers delegates broad authority for awarding contracts and making decisions. Each district has its own administrative, fiscal, engineering, legal and construction staffs, and the district is able to function as a complete entity.

Specific allotments

Funds are provided in the new fiscal year for construction work on 198 flood control projects in 37 states. Largest amount will be spent on Garrison Reservoir, N. D., $26,000,000. Other major appropriations for flood control work are listed for: Fort Randall Reservoir, S. D., $18,000,000; Bull Shoals Reservoir, Ark., $14,000,000; Wolf Creek Reservoir, Ky., $12,400,000; Buggs Island Reservoir, Va., and Center Hill Reservoir, Tenn., $9,000,000 each; Harlan County Reservoir, Neb., Missouri River Agricultural Levees, and Allatoona Reservoir, Ga., $8,000,000 each.

The money earmarked for construction on rivers and harbors is for 79 projects, located in 33 states and in Alaska. Among the important projects with large appropriations are: McNary Lock and Dam, Columbia River, $22,000,000; Mississippi River, between Ohio and Missouri Rivers, $9,000,000; Missouri River at Fort Peck, Mont., $3,700,000; St. Marys River, Mich., $3,000,000; Jim Woodruff Lock and Dam, Fla., $3,000,000; Missouri River, Kansas City, Mo., to Sioux City, Ia., $3,000,000; and Morgantown Lock and Dam, Monongahela River, W. Va., $3,000,000.

OK $82 million sewage plan in Allegheny County

The Pennsylvania Sanitary Water Board has formally approved the $82,000,000 sewage treatment project proposed by the Allegheny County Sanitary Authority.

The authority may now negotiate with the various municipalities for firm agreements as to financing and handling of municipal sewage. Detailed planning, however, must be held up until it is determined which municipalities will participate in the long range agreement with the authority.

In a formal report, prepared after more than a year of studies, the authority recommended construction of a central sewage treatment plant to which will be delivered for treatment the sewage and industrial wastes collected by a main intercepting sewer system of concrete pipe 91 miles in total length and ranging in size from 12 in. to 144 in. inside diameter.

As proposed, primary treatment alone will be prescribed for the central sewage treatment plant to remove substantially all of the settleable solids.

Truman protests, but signs new laws

(*Continued from page* 101)

"Thus, while appropriating $3,000,000 toward the construction of the Canyon Ferry Project in Montana, the Congress has prohibited the construction of previously-authorized power facilities and transmission lines for the delivery of power from the project. In the Central Valley the Congress has failed to include funds for the construction of the previously authorized "west-side" transmission line to carry power from Shasta Dam to the San Francisco area. To bottle up power at these and other federal dams by preventing the construction of previously authorized power facilities and transmission lines, clearly represents a capitulation to special interest groups.

"Furthermore, the act and the conference report portend a reversal of the long established policy of using interest collected on the power investment in reclamation projects to pay off a portion of the irrigation costs. The effect of such a change would be to increase public power and water rates to the people throughout the West."

Government corporations bill

The President accompanied his signature to the Government Corporation Appropriation bill with a pointed reference to the failure of Congress to include an appropriation for a Tennessee Valley Authority steam power station. He said: "The failure of the Congress to include an appropriation . . . for a steam generating plant at New Johnsonville, Tenn., is an ommission of such grave consequence that I hope the Congress will reconsider this question at the earliest opportunity.

"It is inexcusable that there should be delay in providing the energy urgently needed to meet the growing demands of the people of . . . this region, and vitally necessary for . . . national security."

Housing bill denounced

On the subject of housing, Mr. Truman complained that here was another "of the many jobs left unfinished by the 80th Congress." He did not, however, indicate any intention to call a special session to consider changes.

He commented that, instead of passing the Taft-Ellender-Wagner bill, Congress approved a bill liberalizing government purchases of insured home mortgages. The bill he signed authorizes the Federal National Mortgage Association—a subsidiary of the Reconstruction Finance Corporation—to buy up $840,000,000 worth of mortgages insured by the FHA and by GI loans.

He called the measure a "sad disappointment to the millions" in need of homes, and a "failure" in providing both farm housing and slum clearance in urban areas.

Sewer rental increases seen needed to finance rising operating costs

Ohio Sewage Treatment Conference hears of price trends—Pre-aeration of raw sewage reported beneficial

Sewer rental rates in Ohio must be revised upward to provide additional funds for construction of essential treatment facilities and to defray rising operating expenses. A study of five-year financial data from nine sewage plants, was brought to the attention of the Ohio Conference on Sewage Treatment, which met in Dayton recently, by A. H. Niles, engineer-superintendent, sewage-treatment plant, Toledo, Ohio.

Another feature of the three-day program was a discussion of the benefits of pre-aeration as an initial sewage-treatment process.

Sewage-works costs have increased greatly during the past four years. As an example, the proposed pre-aeration and grease removal plant for Toledo was estimated at about $150,000 in 1944. This plant, which was not built due to equipment and material shortages, will cost more than $300,000 today, said Mr. Niles.

To determine how much construction costs have increased in recent years, Mr. Niles, in cooperation with Jones & Henry, consulting engineers of Toledo, re-estimated two sewage-treatment projects using 1948 unit-bid prices for comparable items. The analysis revealed that the first project, built in 1930, and the second plant, completed in 1938, would cost, respectively, 2.75 and 2.60 times more in 1948 than they did originally.

Mr. Niles emphasized the fact that use of the *Engineering News-Record* Cost Index would show increases of only 2.21 and 1.90 times, respectively, for these plants. However, he pointed out that the *ENR* index is based on material prices and hourly wage rates but does correct for job productivity, material substitutions and increases in overhead.

An average factor of 1.3 applied to costs calculated by the *ENR* index would yield engineering estimates of sewage-disposal projects more nearly in line with today's economic conditions, he declared.

Sewage-treatment operating expenses have increased much faster than revenues. The most important factor contributing to this increase is the steady and continuing rise in cost of personal services. Personal-service costs, Mr. Niles reported, amount to about 60 and 85 percent of operating expenses for low and high wage scales, respectively, according to the survey.

Sewer rental rates in Ohio vary widely. The average annual service charge for eleven cities of 100-200,000 population is $4.07 with a high of $6.00 and a low of $2.00; for 30 cities in the 20-50,000 range, the corresponding rates are $4.35, $9.00 and $1.00; and for 92 villages (less than 5,000 population) similar rentals are $5.94, $18.00 and $2.00.

Pre-aeration improves treatment

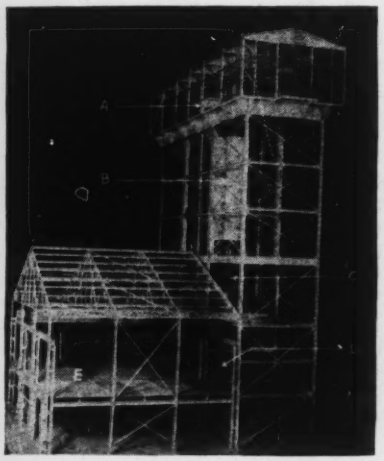
Pre-aeration of raw sewage avoids septicity in primary settling tanks, introduces oxygen, and improves secondary treatment, increases bio-chemical oxygen demand removal in primary units and decreases the load on secondary facilities. These advantages were reported by Carl Bauer, superintendent of sewage treatment, Celina, Ohio on the basis of operating results carefully documented since 1941.

Herbert Hansen, superintendent of sewage treatment, Ravenna, Ohio stated that pre-aeration increases BOD removals 10-15 percent and improves the scum and grease collection. He also said that sludge withdrawn from primary settling tanks is facilitated when raw sewage is aerated.

As a result of mixing raw sewage and chemicals with air, an increase in suspended solids removal was noted by W. E. Conrad, chief operator, sewage-treatment plant, Wooster, Ohio. He said that in all cases where pre-aeration was tested, the final effluent showed a material increase in dissolved oxygen.

Recognizing the importance of industrial wastes, the Ohio Conference on Sewage Treatment voted to change the name of the organization to the Ohio Sewage and Industrial Waste Conference.

New officers of the conference include: Earl F. Wittmer, chairman; Robert Bowman, vice-chairman, and G. A. Hall, secretary-treasurer.



ATOM SPEED UP—The U. S. Atomic Energy Commission has approved construction of this $2,000,000 electrostatic accelerator designed to yield positive ions with energies up to 12,000,000 electron volts. To be the largest and most powerful laboratory research tool of its type in the world, the structure will be built at the University of California's Los Alamos, N. M., scientific laboratory. The building will be a steel structure 120 ft. high, set at the base of a cliff that gives lateral bracing to the tower, and serves as a radiation shield.

Universal Atlas ends basing point prices

First action to end the basing point system of cement pricing, in compliance with the Supreme Court decision of April 26 (*ENR* April 29, vol. p. 622) was taken last week by the Universal Atlas Cement Company. Blaine S. Smith, president of the company, announced his organization will abandon the basing point methods in favor of f.o.b. shipping point pricing, as of July 7.

In a formal statement, Mr. Smith said: "Universal Atlas Cement Company is abandoning on July 7 next the method of selling cement which it has used continuously for more than 40 years, namely sales in the market served by it at delivered prices as low as those quoted by any competitor.

"This step is made necessary by the recent decision of the United States Supreme Court sustaining a cease and desist order of the Federal Trade Commission against Universal Atlas and 73 other members of the cement industry. The order becomes effective on July 9, 1948.

"Accordingly Universal Atlas will adopt the method of selling cement at prices f. o. b. the shipping point, or, if the customer so desires, at delivered prices which reflect full transportation charges from shipping point to destination."

Closely following this action came an announcement by a second multiple-plant producer, Pennsylvania-Dixie Corp., indicating similar price plans effective July 9. The company said it will quote and sell cement f.o.b. railroad cars at the mill or at the buyer's destination.

Discuss better building materials

Improvement of the materials of construction was the theme of several technical sessions at the 51st annual meeting of the American Society for Testing Materials held in Detroit June 21 to 25.

Abstracts of several significant papers follow. Other developments were reported in *ENR* July 1, p 11.

Fourteen papers were presented in a symposium summarizing present knowledge of mineral aggregates for concrete. Subjects covered included distribution, petrographic characteristics, sampling, production, grading and needed research.

A more specialized discussion of mineral aggregates was held in a symposium on methods used in identifying reactive materials in concrete.

Thomas E. Stanton of the California Division of Highways reported in his paper on correlation of laboratory tests with field experiences of excessive concrete expansion induced by a reaction between the cement and aggregate, that the sealed-container mortar bar test gave satisfactory results. He also concluded that when there was less than 0.6 percent of total alkali in the cement, abnormal expansion did not occur. Exception to this conclusion was taken by W. C. Hanna, chief chemist, California Portland Cement Co., who pointed to the possible effect of alkali in the fine aggregate.

R. C. Mielenz and L. P. Witte, both of the Bureau of Reclamation, pointed to the importance of wetting and drying tests. Their paper on tests used by the Bureau of Reclamation for identifying reactive concrete aggregates included discussions of petrographic, chemical and two length-change tests, as well as examination of structures. Petrographic identification of deleterious substances was detailed by Bryan Mather, Corps of Engineers.

Speedy identification sought

Pointing out that mortar bar tests sometimes must be continued for over a year, C. O. Woolf, senior materials engineer, and Theodore R. Smith, senior scientific aid, division of physical research, Public Roads Administration, described a method developed to meet the need for quicker identification of deleterious aggregates. Mortar made with the material to be tested is cast in a glass jar coated with an alkali-proof paint and allowed to harden, after which a small quantity of water is added and the jar sealed. Early cracking of the jar reveals the presence of reactive aggregate. A test period of 28 days appears to be sufficient for the determination.

Additional exposure data on the atmospheric durability of steels containing nickel and copper, supplementing a report in *Proceedings*, ASTM, 1940, p. 643, was presented in the symposium on corrosion by N. B. Pilling and W. A. Wesley, director and assistant director, respectively, research laboratory, the International Nickel Co. The authors conclude that the beneficial effects of nickel upon the weathering resistance of steel increase with increasing nickel content. Addition of copper to a nickel steel, they report, improves the life, but the optimum amount is less than the amount of nickel and remains well below two percent, even with a four percent nickel content. With long exposure periods, there is evidence that not only phosphorus but also silicon additions to nickel-copper steels have a beneficial effect on behavior in an industrial atmosphere.

From studies of 91 brick buildings, C. C. Connor, New Jersey Bell Telephone Co., deduced that roof or parapet wall coverings, high-lime mortars, moderate-rate of-absorption brick, and concave mortar-joint tooling were characteristics of moisture-resistant walls. Wall furring and high retentivity in mortar was also believed to be desirable. On the other hand, the author found the following to be detrimental: spandrel beam waterproofing, parapet flashings that did not completely cut off or cover the top and back of parapets, high or low-rate-of-absorption brick, low-lime mortars, and flat-tooled, rough-cut and raked mortar joints.

AISC engineers report building trends

High costs are beginning to act as a brake in some sectors of the construction industry, engineers of the American Institute of Steel Construction reported last week as they met in New York City for an annual engineering session.

L. Abbett Post, executive vice-president, summarized the engineers' reports by saying that investment building of hotels, apartment houses and office structures is slackening because of high costs, and that industrial plant expansion is slowing because much of the needed postwar work has been performed.

Builder calls N.J. union unfair

Unfair practices by construction unions were charged in a complaint filed in New York last week by the contractor on a $12,000,000 open-shop veterans housing job in Newark, N. J.

Arthur H. Padula, vice-president of the Fairmount Construction Co., Newark, accused the Essex County Building Trades Council and most of its affiliated unions of violating the Taft-Hartley Act on three counts: refusal to bargain; coercive tactics through use of large groups of pickets; and institution of a secondary boycott.

Allege union violations

Mr. Padula, a former Seabee commander, on May 17 discharged 300 union men from his 2,400-unit job, on the ground that local wage rates—increased April 1 to a top of $3.15 an hour—would raise costs above the amount for which the work was financed. He immediately began hiring unaffiliated craftsmen at the previous rates—$2.75 top for bricklayers—and reported completions at the uniform rate of two two-family units a week since May 17. No trouble was experienced in getting men and open-shop subcontractors.

Present hourly rates in Newark include: Bricklayers, $3.15; carpenters, $2.90; laborers, $2.12. These rates, which are 15-40 cents higher than the highest March 1, 1948 rates for those trades (*ENR*, May 27, vol. p. 827), were the outcome of agreements between the Essex County AFL Building Trades Council and the Associated Contractors of Essex County. Mr. Padula's firm does not belong to that contractor group.

The complaint, filed with the regional National Labor Relations Board office in New York, contains affidavits alleging 14 instances in which non-union workers have been approached illegally by union representatives. The complaint also cites seven instances of alleged secondary boycott—one in which a concrete company was persuaded not to deliver, another in which a sheet metal concern was persuaded to drop its contract, etc.

Fraser Holzlohner, Essex AFL building trades chief, said that on June 17 Mr. Padula agreed to try to get the additional backing necessary to allow conformance with union rates. A local bank and the Veterans Administration denied the petition, Holzlohner said. The AFL chief denies all charges, saying, "Padula knows I've preached no violence, no coercion, no threats, since this thing started."

H. E. Wessman named dean at U. of Washington

Harold Everett Wessman, for 11 years head of the civil engineering department at New York University, on June 11 was named dean of the college of engineering at the University of Washington, Seattle, succeeding Dean Edgar A. Loew, who will retire next Sept. 1. Dean Loew served for 42 years on the engineering faculty of the Washington school.

Dr. Wessman attended the University of Illinois where he was awarded his bachelor's and master's degrees in science and his master's in civil engineering. In 1929 he was appointed associate professor of bridge engineering by the Chinese ministry of railways at Chiao-Tung University. In 1930 he was appointed structural engineer of long-span bridges in Rockford, Ill. and in 1933 he was named associate professor of engineering at the State University of Iowa. He earned his doctorate from the University of Illinois in 1936.

New York University selected Dr. Wessman to head its civil engineering department in 1937.

First contract approved for Central Valley water

The California District Securities Commission recently approved the first contract between an irrigation district and the U. S. Reclamation Bureau for water from California's Central Valley Project.

Although water from the project will not be available for at least another year, the commission passed on the contract of the Lindsay-Strathmore Irrigation District in the south San Joaquin Valley to avoid violation of a court order. Since 1936 water users of the 15,000-acre district have been allowed to pump from the underground water table on a court agreement that they would get other water as soon as possible.

The new contract will allow the full amount of water for total use of the acreage, at present 85 percent developed.

Validity of the contract, on which district water users are expected to vote unanimous approval shortly, has yet to be tested in Superior Court. The Commission, which has final authority on all irrigation district contracts, objected to provisions relating to the 160-acre limitation for water users. However, no individual within the district holds more than 160 acres of land according to information before the commission.

Apprentices in training show steady increase

The apprentice training program of the construction industry has done more than hold its high level of May 1, according to a recent summary issued by the Bureau of Apprenticeship of the U. S. Department of Labor.

At the end of May, the reported number of apprentices was 131,288—an increase of 2.4 percent over the 128,208 employed a month earlier.

Totals given in the month-end summaries indicate the trend, but they do not include every apprentice in the country. Actually, the total for June 1 comes from 80 fewer local reports than the May 1 figure. The June 1 total represents 6,901 local groups while the May 1 figure was made up of 6,981 local reports.

Army engineers begin synthetic fuel work

The Corps of Engineers said last week that it had awarded a $110,000 contract to initiate a nation-wide survey for the Department of the Interior to procure basic data for planning synthetic fuel manufacturing plants.

The initial contract covers a sample survey of portions of three states. The survey will be accomplished by the firm of Ford, Bacon & Davis Inc., of New York, N. Y. The three sample regions to be surveyed are western Kentucky, northwestern Colorado and southeast Texas.

Subject to the availability of additional funds, it is planned to follow the initial contract with a survey nationwide in scope that will cover the remaining area of the continental U. S. where the basic raw materials are known to exist.

Flood stages reached on Rio Grande

Swollen by heavy rains, the Rio Grande in Texas late last week had reached flood stages around Corpus Christi and Laredo, with a 45-ft. flood stage at some points.

No great damage to engineering structures was expected, however, since floodways maintained by the International Boundary and Water Commision were expected to be capable of handling the unprecedented flood. The usually narrow and shallow stream was more than 4 miles wide in many places, reports said.

Most of the damage appeared to be concentrated in the low lying farmlands of Mexico, just south of the river.

Propose billion-dollar Indiana road program

A $1,015,000,000 highway financing plan to cover a 10-year expansion program was recommended at a recent meeting in Indianapolis of the Indiana Joint Committee on Street and Highway Programs.

The committee recommended an eight-point financing program by the state that would include increase in gasoline taxes and automobile license fees, for presentation to the Indiana Tax Study Commission.

La. legislature approves two New Orleans bridges

Two bridge projects designed to open new approaches to New Orleans across its water barriers recently won the final approval of the Louisiana legislature. Toll bridges across Lake Ponchartrain, north of the city, and the Mississippi River to the west, were authorized. Legislative approval, however, must be ratified by voters of the whole state in the November general election.

One amendment would authorize the highway department to issue $30,000,000 bonds for a causeway from New Orleans to the Madisonville-Mandeville area of St. Tammany Parish, across Lake Ponchartrain, and $10,000,000 bonds for completion of the Lakeshore approach to the existing bridge to Slidell.

The other measure would provide for a toll bridge across the Mississippi River, in downtown New Orleans.

Approve allocations of Davis Dam power

The Bureau of Reclamation has been authorized to negotiate contracts for power to be produced at Davis Dam in accordance with allocations that will supply the most urgent needs for power.

The office of Secretary of the Interior J. A. Krug reported that applications are now in file for nearly four times the capacity of the Davis Dam power site, from areas in Arizona, California and Nevada.

The dam's power plant will have a capacity of 180,000 kw., of which 50 percent will be distributed in Arizona, 25 percent in California and 25 percent in Nevada. However, pending need by the state of Nevada for its allotted 45,000 kw., this power will be made available temporarily to the cities of Los Angeles, Burbank, Glendale and Pasadena, Calif. Nevada can claim any part of this power on one year's notice.

OBITUARY

David W. Sweet, formerly an evaluation engineer with the War Assets Administration, Washington, D. C., died in that city June 26. Mr. Sweet attended Cornell University and was employed with several government units in a civil engineering capacity, including the Interstate Commerce Commission and the Navy Department. He retired from the government last May 30.

Eugene L. Nusser, 61, an engineer for the Illinois Commerce Commission, died June 26.

Charles H. Morse, 62, Yonkers, N. Y., assistant engineer in charge of maintenance of way for the New York Central System died June 30.

V. L. Nicholson, 65, founder and president of V. L. Nicholson Construction Co., Knoxville, Tenn., died June 28. He was widely known in the South and constructed many outstanding buildings. The firm also maintained an office in Nashville.

Melville Belfry, engineer of the Hydro Electric Commission of Ontario, died at Barrie, Ont., June 26.

South Carolina city to fluorinate water

Fluorination of the water supply of Charlotte, N. C., will be undertaken as soon as equipment can be installed, city officials said.

The city purchasing department has been instructed to obtain prices on the fluorination equipment and sodium fluoride for the process. Dr. Z. M. Stadt, director of dental hygiene of the Charlotte health department, will cooperate in close supervision and careful checking on results of the experiment.

The fluorine dosage will be of one part per million parts of water.

Connecticut engineers urge conservation

The Connecticut Technical Council, whose membership includes most of the engineering societies of the state, has endorsed a program advocating conservation of our natural resources, and called it to the attention of about 150 scientific and engineering societies throughout the country. The program was drawn up by a special committee under the chairmanship of T. J. Russell of the Westinghouse Electric Corp. Among other things, it urges engineers to insist that foreign aid be paid for in raw materials as a protection to our dwindling stock piles; to support and promote scrap drives, and to oppose shipment of scrap and other materials to nations of doubtful friendliness; to support legislation for the protection of our forests and agricultural land; and "to do all possible to bring about world government so as to avoid a third World War that would not only use up all of our resources but wreck our civilization as well."

Group fights pollution of Housatonic River

The Housatonic Valley Planning Association has been organized to fight pollution of the Housatonic River in Connecticut. Charles Downing Lay, of Stratford, will head the organization as president, and state officials and civic groups have indicated complete cooperation in the long range planning programs.

Plan reconstruction of C. W. Cullen bridge

Plans for the permanent reconstruction of the Charles W. Cullen bridge across the Indian River at Rehoboth Beach, Del., have been completed and filed with the U. S. Army Engineers for approval, it was announced June 26.

The plans, calling for construction estimated to cost $450,000 are on file with the Philadelphia district office of the Army Engineers and represent the first step in eventual rebuilding of the destroyed bridge.

Three men died when the original bridge collapsed last Feb. 10 (*ENR* Feb. 26, vol. p. 312).

At present, a temporary span connects the sections of the Atlantic Coast Highway between Rehoboth Beach and Bethany Beach.

MAJOR MEETINGS

American Road Builders Show, Soldier Field, Chicago, Ill., July 16-24.

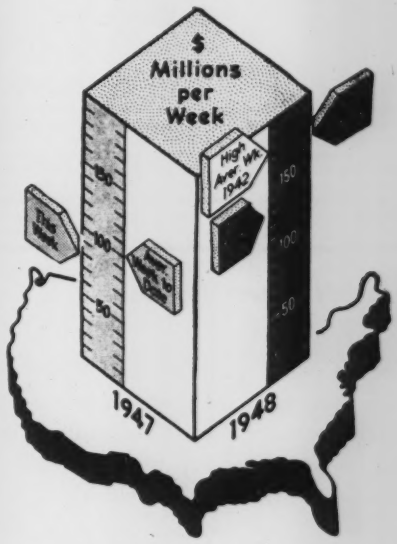
American Society of Civil Engineers, Annual convention, Hotel Olympic, Seattle, Wash., July 21-23.

Oregon Traffic Engineering Conference, Oregon State College, Corvallis, July 29-31.

Regional Surveying Teachers Conference, Green Engineering Camp, Ringwood, N. J., Aug. 26-28.

National Council of State Boards of Engineering Examiners, annual meeting, Hotel Utah, Salt Lake City, Utah, Aug. 26-28.

CONSTRUCTION ACTIVITY



As Reported this week to...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of July 8 1948	Cumulative 1948 (28 wks.)	Cumulative 1947 (28 wks.)
Federal	$14,012	$562,978	$375,708
State & Mun.	54,663	1,300,976	879,569
Total Public.	$68,675	$1,863,954	$1,255,277
Total Private	100,043	1,799,056	1,602,877
U. S. Total.	**$168,718**	**$3,663,010**	**$2,858,154**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (28 wks.)	Cumulative 1947 (28 wks.)
Waterworks ...	$1,431	$102,050	$59,359
Sewerage	4,527	113,582	69,704
Bridges	3,955	157,482	87,081
Highways	24,749	535,785	423,499
Earthwork, Waterways	7,813	286,301	173,556
Buildings, Public	20,288	558,359	292,091
Industrial ...	8,126	549,278	409,764
Commercial .	12,125	1,023,285	941,308
Unclassified ...	85,704	338,908	401,792

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (28 wks.)	Cumulative 1947 (28 wks.)
NON-FEDERAL ...	Current	$1,002,671
Corporate Securities	Figures	392,080
State and Municipal	Not Available	610,591
Total Capital		**$1,002,671**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost..	July '48	463.23	222.67
Building Cost	July '48	342.42	185.10
Volume	June '48	282	124

EDITORIALS

VOLUME 141 NUMBER 2

JULY 8, 1948

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ENGINEERING NEWS-RECORD is a consolidation of Engineering News and Engineering Record, effected in 1917. The Contractor was consolidated with Engineering News Record in 1918. Engineering News was founded in 1874 as The Engineer and Surveyor, which title subsequently became The Engineer, Architect and Surveyor. Engineering News and American Railway Journal and finally Engineering News. Engineering Record was established in 1877 as The Plumber and Sanitary Engineer. Subsequently it became The Sanitary Engineer, Engineering and Building Record, and, finally, Engineering Record. All rights to the above titles are reserved.

Voters Must be Sold

REJECTION by voters in Portland, Ore., of a tax levy to pay part of the right-of-way costs for a freeway project gives emphasis to the fact that such measures must be sold to voters. That this measure suffered from lack of official support, or at least from a lack of official publicity-know-how, is evident from the fact that a model of the freeway prepared for design purposes lay boxed up in the city hall when it might have been on display at some prominent point. Not knowing what they were voting for, the voters turned down the proposal even though the city was required to pay less than 20 percent of the total project cost. Securing passage of proposed public-benefit expenditures placed on a ballot calls for educational effort and widespread discussion by public officials and civic-minded citizens. Voters will not respond to a laissez faire attitude, least of all in these days of high taxes and high construction costs.

Needless Duplication

SIMULTANEOUS ANNOUNCEMENTS of preliminary plans for a high dam in Hell's Canyon on the Snake River near the Idaho-Oregon border by the Army Engineers and Bureau of Reclamation again points to the need for a better definition of the activities of these two federal construction agencies. Each one finds legislative authority for this planning in recent acts of Congress, as was the case when the two agencies came up with plans for the development of the Missouri River basin. Now both are studying the Columbia River basin, and it is natural and understandable that each agency should seek to play a large part in a program for further development of that river's resources. Hence, the need for Congress to be more specific as to which agency is to do the planning for a particular river basin. When irrigation needs as well as navigation and flood control are involved, logic would appear to point to the desirability of Congress instructing the two agencies to set up a joint board of engineers to make the preliminary study. After a plan has been approved, that board could allocate an individual project to the agency best equipped to handle it.

A Costly Custom

CAISSONS FOR BRIDGE PIERS are customarily loaded with steel ingots, railroad rails or some other kind of weight to aid in their sinking. Why? A contractor on a current bridge job has figured that he could have made a substantial saving if the caissons had been designed large enough to sink of their own weight. If he is right, engineers should take notice. Without question, the cost of renting, trucking and handling weights is a substantial item. This particular contractor estimated that it exceeded the cost of the additional excavation and concrete required to make larger piers sink by themselves. Making piers larger than is absolutely necessary to carry the bridge itself might violate esthetics or tradition, but between a setback for art or custom and a saving in dollars, the owner should, at least, have his choice.

Economies Through Aerial Mapping

NEW HORIZONS in accurate topographic mapping of large cities are foreseen in a large-scale experimental project in photogrammetric surveying undertaken by the Cleveland Regional Geodetic Survey (*ENR* June 17, vol. p. 992). Initially, the plan calls for complete aerial surveying of Cuyahoga County, Ohio, (450 sq. mi.) together with topographic maps covering 6 sq. mi. in the heart of Cleveland at a horizontal scale of 1 in. equals 200 ft., with 2 ft. contours. This ambitious project has for its objective the preparation of topographic maps by aerial methods as accurate in horizontal and vertical controls as those prepared by plane-table surveys but at considerable savings over conventional methods. Savings in time and money were made through the use of aerial methods in locating a line for the easterly extension of the Pennsylvania Turnpike, as told on p. 131 of this issue. That work cost one fifth of what ground surveys of comparable accuracy would have cost and was accomplished in one fifth of the time.

Both the Cleveland program and the Pennsylvania results warrant careful study by any agency needing mass production of accurate topographic maps.

Good Neighbors—Bad Logic

ONCE UPON A TIME, the United States had a wonderful idea about helping the Latin American countries to help themselves. Under the direction of the Office of Coordinator of Inter-American Affairs, cooperative programs in health, sanitation, education and food supply were set up in 1942. These programs were truly cooperative, particularly in the sense that the participating governments made financial contributions, the ratio increasing each year until today they average $2 for every dollar put up by the U.S.A.

Since the U. S. in large measure directs the manner in which the money is spent, the idea must be good so far as 14 of the Latin-American countries are concerned or they would not be supporting it to the extent of $21 million in commitments for the next two years. And last year the Congress thought so highly of the programs as "instruments of United States foreign policy" that a new charter was issued to carry on the work under the Institute of Inter-American Affairs. At the same time, the Congress authorized a $10 million expenditure for fiscal years 1949 and 1950.

Not entirely lost in these deliberations must have been the knowledge that the value of U. S. pharmaceutical exports had increased from $18,000,000 to $61,000,000 in the first four years of the program; also that much of the materials and equipment to build 113 water supply systems, 83 hospitals and 85 health centers had been purchased in the U. S., and in addition, the educational program was creating a knowledge and desire for agricultural and other types of machinery.

All of which leads to the question: Why did both the House and Senate appropriations committees agree to lop off $1,348,500 from the 1949 budget and refused to consider any appropriation for the 1950 program? This niggardly attitude not only puts a serious crimp on our administration of what is generally conceded to be an effective program, but goes even further to impugn the good faith of our government. On the basis of earlier Congressional authorizations to the institute, the Latin-American governments provided their share of the money to go into the joint venture. The only conclusion seems to be that in our professed role of "good neighbors" we are using some bad logic.

Cutting Roadbuilding Costs

SOME RELIEF from the postwar upward spiral of construction costs is seen in the trend of recent bid prices. Today they are 91 percent above 1940 prices, 34 percent above those of two years ago but only 12 percent above prices prevailing this time last year. While it cannot safely be assumed that construction prices have reached their peak, possibly they are entering a leveling-off phase. Factors causing construction prices to rise, such as premium payments for overtime, lack of productivity and a host of others affecting the end product all along the line clear back to the raw material, are well known. But not so well known are those measures adopted during the past several months to stem the high costs of construction.

Presented in detail in this issue are cost-cutting measures by contractors and highway engineers which have proved successful in retarding these ever-mounting prices. Points worthy of note include measures taken to reduce hand labor and the design of structures to permit maximum reuse of form lumber. Reinforced concrete is being substituted for hard-to-get structural steel, and local materials are being used wherever possible. Some states find it profitable to increase the size of projects to attract larger contractors. Other engineers separate certain work into smaller contracts or into several classes of work to encourage the small contractor or to stimulate specialization. Contractors see better results as well as economies in specifications calling for results instead of prescribing methods.

Never before has the highway construction industry had access to such improved equipment designed to do a better job and at reduced costs. But to realize its full potentialities both the engineer and the contractor must exert more cooperative effort to see that construction jobs are set up and properly prosecuted to secure maximum results at minimum costs.

ENGINEERING NEWS-RECORD
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FIG. 1. CONCRETE-ARCH ROOF construction makes possible a 130 x 230-ft. skating arena unobstructed by columns.

Arch Roof with Dome-Ends Provides Unobstructed Area for Skating

A COMBINATION skating rink, bowling alley and 300-car garage—one of the first buildings in the country where the roof consists of a concrete barrel-arch with semi-dome ends—has gone into service in Washington, D. C. The design permits a column-free skating rink on the second floor.

The barrel-roof portion has a clear span of 130 ft. and a length of 100 ft. The building is inclosed at either end by a semi-dome built to a radius of 65 ft., making the total inside length 230 ft.

Several layouts for the columns supporting the skating-rink floor were studied, but the final choice was square columns averaging 2x2 ft. and spaced about 25 ft. each way. This makes it possible to park three cars between columns while permitting convenient shifting of the vehicles. The spacing also accommodates four bowling alleys in each bay.

The skating-rink floor is of pan construction, designed for a live load of 150 psf. The minimum thickness is 3 in. To eliminate excessive noise at the lower level when the skating rink is in use, the concrete floor was covered with a waterproof paper and a ½-in. thickness of insulation board, topped with a 1-in. maple flooring on 1¼x6-in. nailers on 7-in. centers.

Thin-shell roof stiffened by frames

The barrel roof slab is 3½-in. deep at the crown and is thickened to 5 in. where the barrel is restrained into the adjoining members. Rising 23 ft. to provide a clearance of 43 ft., at the crown the slab is stiffened on 25-ft. centers by concrete frames.

The ribs of the frames are 1 ft. 8 in. wide. They project 4 ft. above the barrel at the crown and 7 ft. at the springing line, being placed above the slab to provide a smooth ceiling. Hinged at floor levels, the columns of the frames are 2 ft. 6 in. wide and vary in depth from 6 ft. 3 in. at the springing line to 4 ft. at floor level. They are independent of the concrete exterior walls.

The semi-dome ends are polygonal in plan and consist of segmental portions with supporting columns located along the springing line at the intersection of segments or 25 ft. 7 in. c. to c. Providing straight lines in the horizontal direction for its entire height, the segmental dome permitted simpler formwork than that required for a circular dome. Thickness of slab is the same as for the barrel portion, and stiffening ribs located along the intersection of the dome segments are 1x1 ft. in cross section where they intersect at the apex of the semi-dome.

Where each semi-dome end joins the barrel arch, a stiffener rib 15 in. wide and 4 ft. 3 in. high is used. An expansion joint is provided at this point, as it is between barrel sections. Diagonal bars between two layers

of wire mesh reinforced the roof, which was designed for a wind load of 20 psf. and a snow load of 30 psf.

Forms supported on timber trusses

One of the half-domes was the first part of the roof to be built. Centering consisted of a timber truss in the plane of each stiffening rib, plus intermediate radial trusses for the lower portion of the dome (Fig. 6). Supports for these trusses consisted of 6x6-in. posts arranged in bents, with a total of 85 posts being used.

The trusses were assembled in sections on the skating rink slab by means of shear connectors and raised into place with a gin pole that was shifted about manually. Spanning between the trusses were 2x10-in. joists on 2-ft. spacing, over which $\frac{5}{8}$-in. plywood was placed.

The barrel was then built in three sections, moving progressively from the completed semi-dome end. The first and third sections, 37 ft. 6 in. wide, consisted of a full span and one-half of the next span. The second section was 25 ft. wide.

The falsework supporting the form used to construct the three sections of the barrel-arch consisted of a unit 38 ft. long, mounted on rails to permit the form to be rolled ahead after construction of a given section (Fig. 3). The centering was designed to support a load of 60 psf., and when it was fully loaded, the maximum deflection at the crown of the roof was not to exceed $\frac{3}{8}$ in.

The upper portion of the falsework consisted of six transverse prefabricated timber trusses supported on twelve 6x6-in. timber posts. Double trusses were used in the plane of each stiffening rib. Between the trusses and the supporting posts screw jacks were employed for accurate alignment of the form and to allow it to be lowered a few inches after completion of a given section (Fig. 4). Framing between the trusses were 2x10-in. joists on 2-ft. spacing, and on these members $\frac{5}{8}$-in. thick, 4x8-ft. plywood sheets were placed.

Once the falsework unit was in correct position for a given pour, extensive blocking was added at the base of the falsework to distribute the load evenly over the completed floor slab (Fig. 5). Temporary shoring was used below this floor.

As in building the semi-dome end,

FIG. 2. CONCRETE for the roof was raised by a materials tower, distributed by buggies and chuted into place.

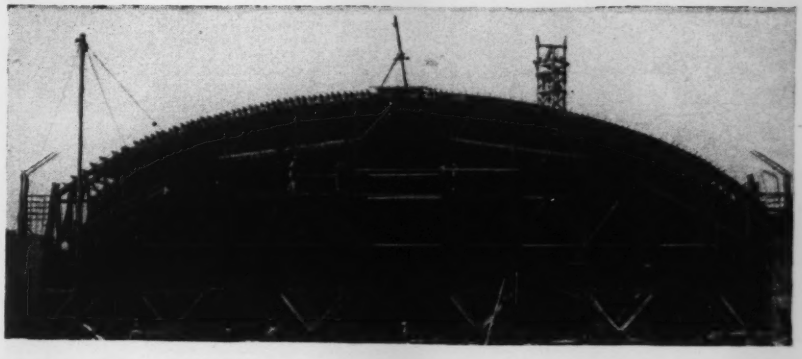


FIG. 3. THE FORM UNIT for the barrel arch was of a sturdy design that could be rolled ahead as work advanced

FIG. 4. FINAL ALIGNMENT of the forms was accomplished with screw jacks mounted in the posts supporting the trusses.

FIG. 5. DURING PLACING of concrete for the arches, special blocking was used under the falsework to distribute loads more uniformly.

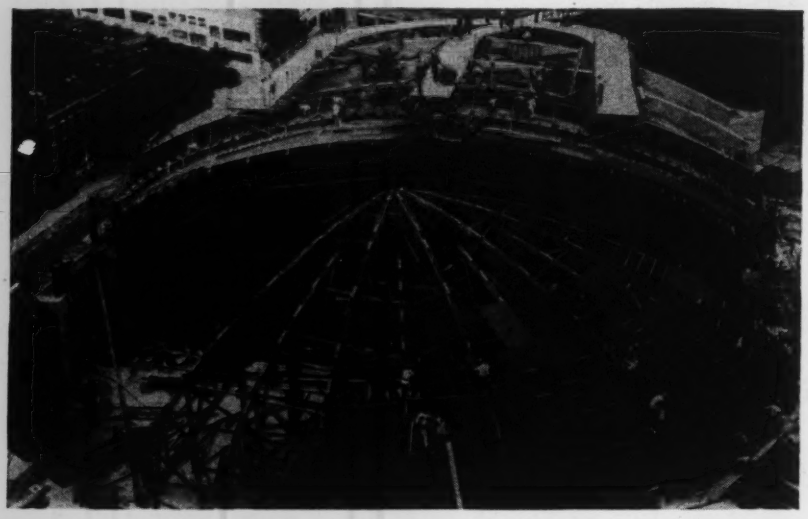


FIG. 6. THE FORM for each semi-dome end was supported on a timber truss in the line of each stiffening rib, and intermediate radial trusses. Truss sections were raised into place manually by means of a gin pole.

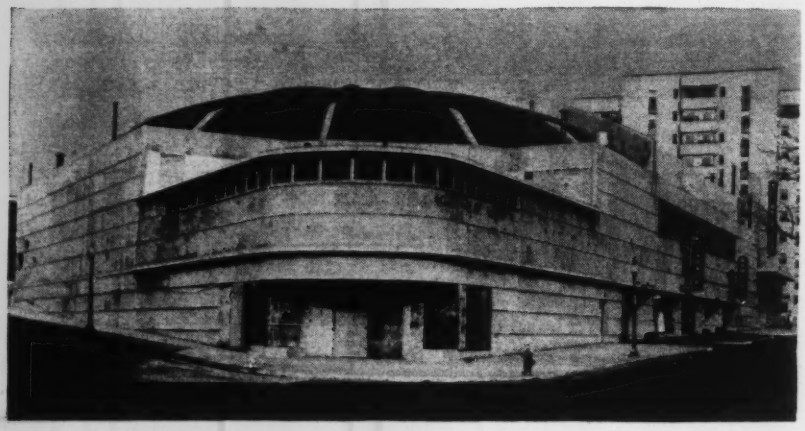


FIG. 7. EXTERIOR WALLS, of cast-in-place concrete, are independent of the columns supporting the roof of the combination skating rink and garage.

concrete for each barrel section was placed in one continuous operation. All the concrete, which totaled 12,000 cu. yd., was delivered by truck-mounted mixers to a materials tower at one end of the project. At this point, it was elevated by skip to the crown of the roof for distribution in rubber-tired buggies (Fig. 2).

No top forms required

Concrete was designed for a minimum strength of 3,000 psi. at 28 days. The mix for a 5-cu. yd. batch normally was as follows: High-early-strength cement, 3,290 lb.; sand, 5,795 lb.; and gravel, 10,345 lb., the maximum size aggregate being limited to $\frac{3}{4}$-in. dia.. material. The water in the concrete was limited to $5\frac{1}{2}$ gal. per bag of cement to keep the slump between 3 to 5 in. With this slump, no top forms were required for even the steepest portion of the roof slab.

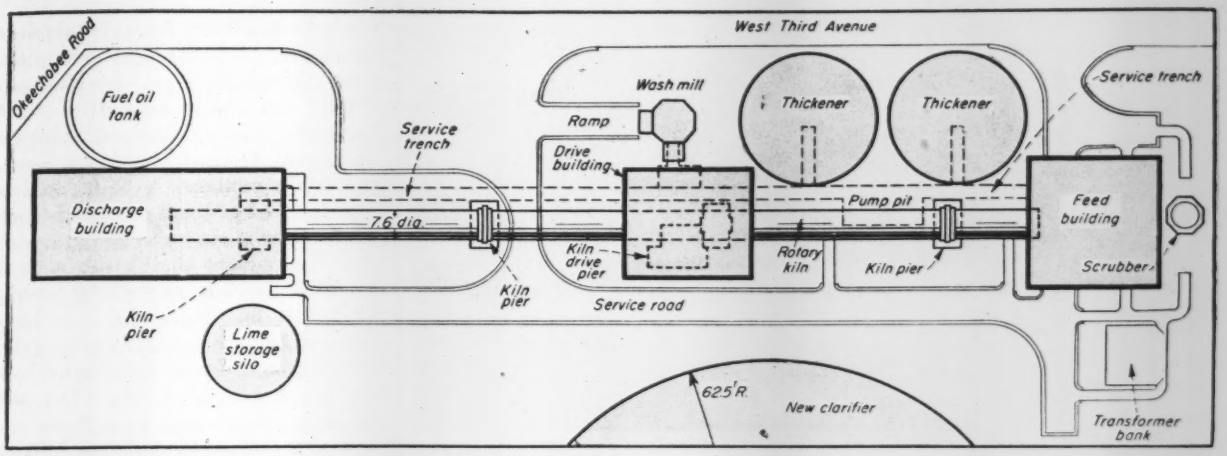
Concrete for the second semi-dome was placed last. Falsework for the forms for this portion of the roof consisted of those used for the other end, dismantled in sections and re-erected at the new location.

Each semi-dome end required 200 cu. yd. of concrete, each short roof section 110 cu. yd. and the longest roof section 165 cu. yd. Most of the concrete was vibrated in place, finished with hand trowels and cured with a membrane compound.

As a last operation, the roof was surfaced with built-up roofing. On the steeper portions, the surfacing was secured in place with horizontal 1x1-in. nailer strips embedded in the surface of the concrete at 4-ft. intervals. These strips also served as screeds and were fixed in place by wiring to the mesh reinforcing of the roof slab.

The architect-engineer contract for the work was held by Frank Grad and Sons, Newark, N. J., and Washington, D. C. Roberts and Schaefer Co., Chicago, was employed as designing and supervising engineer for the roof of the structure, and Edward E. Ashley, New York, as consulting mechanical engineer.

Charles H. Tompkins Co., Washington, D. C., was the general contractor. For this firm, J. S. Davidson, Jr., is chief engineer, Patrick G. Caton served as resident engineer on the job and Bruce Hutzler was general superintendent.



LIME RECLAIMED from sludge will permit . . .

. . . Cutting Water-Softening Costs

C. F. Wertz
Resident Engineer,
Department of Water and Sewers
Miami, Fla.

A LIME-RECOVERY PLANT now under construction at Miami, Fla., will not only produce all of the lime needed by the Department of Water during the next 15 to 20 years but also will provide an excess for sale. A yearly saving of approximately $84,000—enough to pay for the project in a few years—is expected.

Miami's raw-water supply has a total hardness averaging 260 ppm. and a calcium hardness of about 220 ppm. Obtained from 22 wells averaging 80 ft. in depth, the water has a fairly high organic color, averaging 60 ppm. Softening and color removal is accomplished by lime treatment and alum coagulation.

Raw water is softened with a lime feed of 10 grains per gal. to an average total hardness of 80 ppm. With an average calcium-oxide equivalent of 90 percent, about 1,800 lb. of lime per 1,000,000 gal. of water (54 tons of quick lime per day) are consumed in water treatment.

Lime is obtained from Sherwood, Tenn., but some is secured from St. Genevieve, Mo., Batesville, Ark., and other points. Freight charges are nearly equal to the cost of lime at the point of manufacture. The average cost of lime per ton delivered on the plant siding was $15.71 in 1947; total yearly cost is about $175,000. Moreover, since 1944 it has become increasingly difficult to obtain a dependable supply.

After extensive feasibility studies, construction of facilities to recover lime from sludge at the water plant was decided upon. The recovery plant will have a capacity of 80 tons of lime per day from cake containing 35-percent moisture.

Main features of plant

Principal units of the reclaiming plant are: Two sludge thickeners, one wash mill, three slurry pumps, one special slurry feeder, one centrifugal filter, one rotary kiln with drive, one "Unax" cooler, one lime silo, one tower scrubber, one induced-draft fan, two carbon-dioxide compressors, a central control panel, a dust collector, two effluent (sump) pumps, and a bridge crane.

The sludge thickeners are each 32 ft. in diameter and have a 14-ft. water depth. Each thickener has a stirring mechanism that can be speeded up to act as an agitator when clarifier sludge is heavier than desirable for feed to the centrifugal filter.

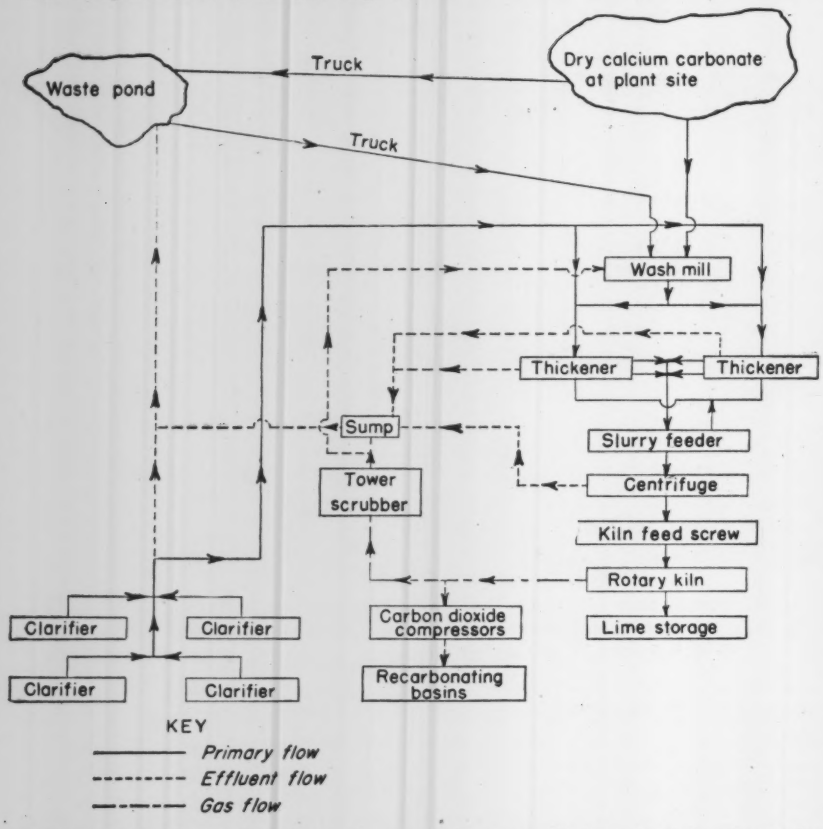
The wash mill is 10 ft. in diameter. It has a capacity of about four tons of 50-percent moisture sludge per hour.

When reclamation is started, the amount of wet calcium-carbonate sludge produced in the softening plant will be barely sufficient to provide 50-percent loading of the kiln. Since this condition would reduce kiln efficiency considerably, a wash mill is provided so that dried sludge from a lagoon can be mixed into a slurry with about 20-percent solids. The slurry will be delivered to thickeners as make-up to maintain kiln operation at a minimum of 75 percent of rated capacity. This loading will tend to maintain fuel efficiencies and provide about 25 tons per day of excess lime for sale.

One slurry pump with a capacity of 5 tons of dry solids per hr. is located between the wash mill and thickeners. Duplicate pumps with capacities of 7½ tons of dry solids per hr. in a 20-percent slurry are located between the thickeners and slurry feeder. A four-speed motor on the slurry feeder is synchronized with a four-speed motor on the kiln drive so that feed to the centrifugal filter will be in direct proportion to rotation speed of the kiln. The slurry feeder will discharge directly into the centrifugal filter.

The centrifugal filter, a 40 x 60-in.

COOLING CYLINDERS on the discharge end of the rotary kiln will reduce lime temperature to about 600 deg. F.



DRIED SLUDGE, trucked from the waste lagoon, will be mixed in the wash mill with water to form a slurry. Delivered to the thickeners, the slurry will be used to bring plant loading to a minimum of 75 percent capacity.

unit, is designed to dewater sludge containing 15 to 20 percent of calcium-carbonate solids and discharge a cake having a moisture content of about 35 percent. It is expected to dewater enough sludge to produce 60 tons of finished lime per day. There is to be space for a second unit.

The cake will be fed uniformly into the wet end of the kiln. Filtrate, containing approximately two percent of solids and amounting to about 65 gal. per min., will drain into the wastewater sump.

Duplicate sump pumps of 600 gpm. capacity will deliver all wastes to the existing lagoon.

Designed to produce a ton of lime for each 8,500,000 B.t.u. (equivalent to 64 gal. of fuel oil per ton), the rotary kiln will be 6 to 6½ ft. in diameter and 230 ft. long. It is to be lined with 6 in. of fire brick, plus an additional 2½ in. of insulating brick in certain sections. A 35-ft. section near the feed end will contain a chain recuperator made up of 243 pieces of ⅝-in. figure-eight chain, with a total length of 2,675 ft. and a total weight of 13,000 lb. Chains that will loop into and ball the wet cake entering the kiln are hung from both ends. Tests indicate that a temperature of between 2,100 and 2,200 deg. F. in the firing end will produce a perfectly burned and well-nodulized lime.

A cooler consisting of eight cylinders, each 3 ft. in diameter and 15 ft. long, surrounds the periphery of the hot end of the kiln. The cooler will reduce lime temperature to about 600 deg. F. while preheating air for combustion to nearly 350 deg. F. A cast-iron conveyor scroll in each cylinder will move the material and provide for full contact between air and hot material.

The finished product will be delivered from the cooler to a 400-ton steel silo by screw conveyor and bucket elevator.

Fuel consumption is 5,100 gpd.

At full capacity of 80 tons per day, fuel consumption of the reclaiming plant will be about 5,100 gpd. Storage for 100,000 gal. of oil will be provided by converting an existing 30-ft. dia. steel mixing tank. Oil-firing equipment will include a 15-hp. boiler that will provide sufficient steam to preheat the heavy bunker coil.

Temperature of outlet gases from the kiln is expected to be below 550 deg. F. These gases, containing some lime dust, will be carried through ducts from the kiln to the top of an atomizing section of the tower scrubber. After passing a double atomizing water spray, the gases will pass to the bottom of a 6-ft. dia., 50-ft. high cast-iron tower. Four additional water sprays at various levels will remove all dust and reduce gas temperature to about 100 deg. F., thereby condensing most of the water vapor. Water consumption will be 250 to 400 gpm.

At full plant capacity, the resultant gases will have the following approximate daily analysis: Carbon dioxide, 119 tons per day or 35.3 per-

cent; nitrogen, 204 tons or 60.5 percent; water vapor, 14 tons or 4.2 percent; and sulphur dioxide, trace. At a 75 percent rating—60 tons of lime per day—the carbon dioxide will amount to approximately 89 tons.

A maximum of 10 tons of the carbon dioxide will be used for recarbonation in water-softening plant. Excess gas will be wasted until construction of a dry-ice plant becomes feasible.

Draft through the kiln, duct work, and tower scrubber is provided by an induced-draft fan, with a capacity of 12,500 cfm. of moisture-saturated exhaust gases at 90 deg. F. Total draft loss is estimated at 7½-in. water column.

Since carbon dioxide is used in the water-treatment plant to reduce pH from 10.5 to 7.5, two compressors will be installed in the feed building. Pump suctions will be taken from the duct between the tower scrubber and the induced-draft fan. Each compressor will have a capacity of 570 cfm. of gas at 8-psi. pressure.

Automatic equipment will permit close control of water pH leaving the carbonating basin by controlling the feed of carbon-dioxide gas. This equipment consists of a pH recorder-controller actuated by electrical impulse from an electrode assembly through an amplifier. The comptroller, in turn, actuates a butterfly valve in the carbon-dioxide gas line by air pressure.

The lime-burning plant has a complete central control panel board with the following major units: an electrical position-indicating unit for the main kiln gas damper, including open and closed indicating lights; a single-point draft gauge, measuring draft at the feed end of the kiln, strip type pyrometer indicator and recorder; start and stop switches for all main motors; an alarm device for the induced draft fan; magnetic counter to register total revolutions of the kiln; high- and low-level indicators for lime silo; an oil flow meter; and an air-operated automatic combustion control. Oxygen and carbon dioxide analyzing equipment will be included.

Plant to cost $550,000

Construction of the recovery plant is being done on a cost-plus-percentage contract. Final total cost will approach $550,000, not including engineering. Delays due to the 1947 South Florida flood have moved the completion date ahead to November 1948.

At the time of the consulting engineer's original report, in early 1944, it was estimated that the cost for producing one ton of lime, including interest and amortization of investment, would be $6.25. With construction costs 80 percent above the original estimate, fuel-oil costs up 60 percent, and labor costs up 35 to 45 percent, the present estimate for production of a ton of lime is $9.90. However, the cost to the city of Miami for purchased lime has been steadily increasing from a figure of $12.75 per ton in 1944 to $17.83 per ton at present.

During 1947, Miami purchased 10,320 tons of lime for $162,170 or at an average price per ton of $15.71. On numerous occasions sufficient quantities of lime for full treatment were not available. It is estimated that 12,000 tons would have been purchased had it been available. The $7.90 per ton saving on 12,000 tons will amount to $94,800 per year and this saving will increase as consumption increases.

The saving is expected to pay off total investment in from 6 to 7 years. Additional profit is expected from sale of some 8,000 tons of lime produced, over and above the city requirements, during the first 6 or 7 years.

C. F. Wertz is resident engineer for the Department of Water and Sewers on the construction of the recovery plant for the city of Miami. He reports to W. A. Glass, director of the department. The planning and detail design of the plant was done by Lime Industry, Management and Engineering of Hershey, Pa., with W. R. Cliffe, head of the firm, and Dr. C. R. Atherton, chief engineer in charge of design.

The kiln and other major items of equipment were supplied by F. L. Smidth & Co., of New York City. The general construction contract is held by Fred Howland, Inc., of Miami, Fla.

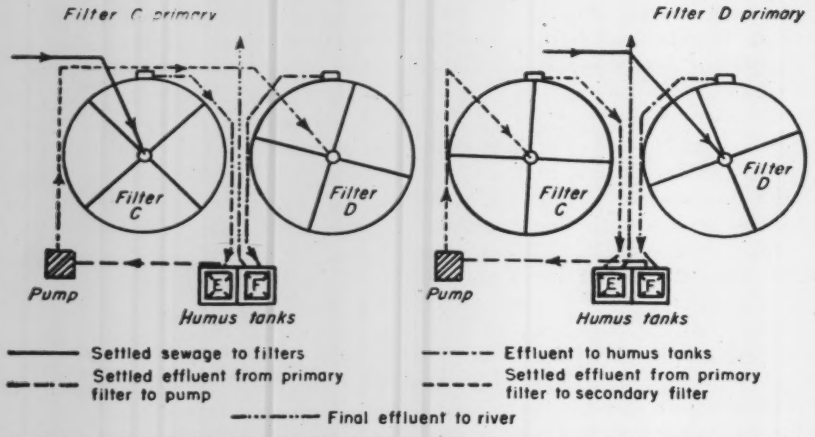
Light Weight Fiber Concrete Developed at University of Michigan

A light-weight fiber concrete, several times more resistant to damage by fire than normal sand-cement concrete, was developed at the University of Michigan during the war, according to a research report on light-weight aggregate materials now on sale by the Office of Technical Services, Department of Commerce. The document is a final report on wartime research sponsored at Michigan by the Office of Production Research and Development of the War Production Board.

Fiber concretes were among many types of light-weight cement-bonded aggregate compositions investigated. The object was to investigate "hard-setting, light-weight plastic compositions having lattice of fibrous materials, a binding matrix of portland cement, and a chemical admix; and suited to be formed by machine into a sheet, or into an insulative panel or floor covering in bulding construction, or to be poured, sprayed, or otherwise applied in factory or field fabrication." The composition sought was to be resistant to fire, rot and termites, for exterior exposure.

More than 8,000 specimens from 225 different materials were prepared and examined. A large number of these compositions had specific merits. One such composition was a solidified "foam" that is actually lighter than cork. In the density range of about 75 lb. per cu. ft. some of the compositions developed compressive strength of above 4,000 lb. per sq. in. and tensile strength of 750 lb. per sq. in. In the density range 40-50 lb. per cu. ft., about the weight of hard wood lumber, many of the compositions showed sufficient strength to be of practical use in building construction.

Mimeographed copies of the 185-page report (PB-25373: Properties of assorted light-weight aggregate materials) sell for $2.00. Orders should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C. Make check or money order payable to the Treasurer of the United States.



In "alternating double-filtration", the first cycle of treatment for settled sewage is: primary filter C, humus tank E, secondary filter D and humus tank F. Reverse flow is: primary filter D, humus tank F, secondary filter C and humus tank E.

Alternating Double-Filtration Speeds Sewage Treatment

NEW INFORMATION on "alternating double-filtration", which is said to be a promising method of sewage treatment, is reported by the Water Pollution Research Board of Great Britain's Department of Scientific and Industrial Research. At a large experimental plant in Minworth, Birmingham, sewage has been treated successfully at three times the rate possible with single filtration. Latest data is contained in a pamphlet, *Water Pollution Reasearch 1939 to 1945*, issued by the board and available from H. M. Stationery office, York House, Kingsway, London, W.C. 2. For an earlier report see *ENR*, Aug. 13, 1942, vol. p. 217.

As shown in the flow-diagram, settled sewage is treated in four steps: primary filter C, humus tank E, secondary filter D, and humus tank F. Final effluent is discharged to the river. The liquid delivered to the primary filter is settled sewage and that passed to the secondary unit is much weaker primary effluent. As a result biological film tends to build up in the primary unit.

After a certain interval, the flow between the filters is reversed. The treatment sequence then becomes: filter D, humus tank F, filter C and humus tank E. Filter C which previously received settled sewage and in which the biological film has accumulated, now receives settled primary effluent. This causes film to break up and be washed through the filter.

In experiments the flow at first was changed weekly and later daily.

The "alternating double-filtration process" depends on the intermittent cleaning effect of the primary effluent. The rate of treatment by single filtration is limited by the growth of film. By restricting the accumulation of obstructive growths, the alternating procedure enables the settled sewage to be treated at a higher overall rate for a given volume of filtering medium.

Some of the more important results of operation are given in Table I. The rate of treatment in the single filter varied from 60 to 65 gal. per cu. yd. of medium per day. It was found that, during the winter months, the surface of the single filter became choked with biological film and deposited material and that ponding occurred when the rate of feed was greater than 60 gal. per cu. yd. per day.

While much higher rates of treatment were applied to the double-filter plant, much less ponding resulted. In the single filter growths were washed out during the spring, but this occurred much earlier in double filters.

In the alternating process, most of the purification took place on the primary filter. Usually settled primary effluent has been of such quality that it could be discharged to the stream. On occasion biochemical oxygen demand exceeded 2 parts per 100,000, but values of 4 to 5 parts per 100,000 were sometimes obtained.

The final effluent from the double-filter plant contained greater concentrations of ammonia and smaller amounts of nitrate than did the single filter effluent. Most of the oxidation of ammonia to nitrate took place in the bottom 2 ft. of the single filter. In the primary filter of the dual setup, comparatively little nitrification occurred. Most of it occurred in the region two feet above the bottom.

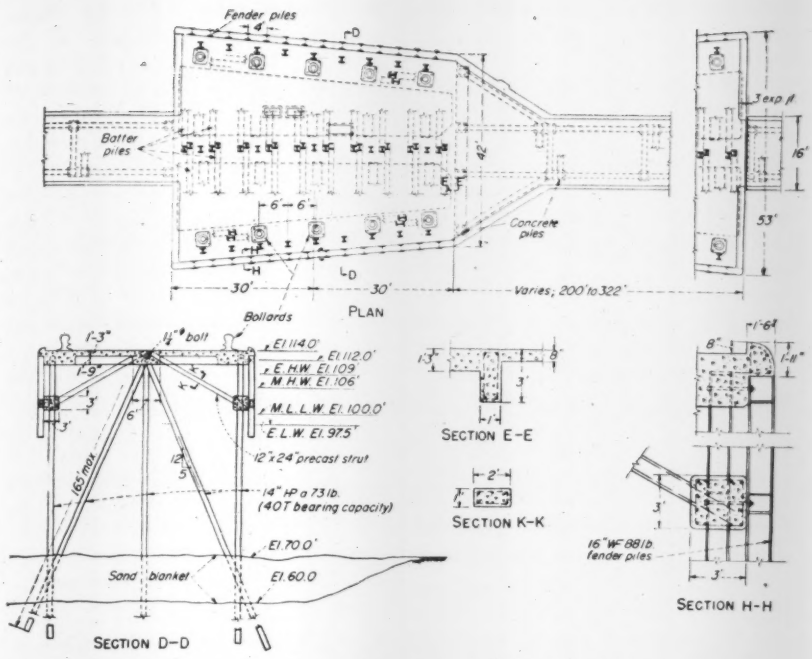
When primary liquid was treated in the secondary filter, concentration of nitrate decreased as it passed downward through the top 2-ft. layer. However, the concentration increased again in the deeper layers.

Effluents from the two processes are substantially of the same quality. The advantage of this development is that a considerably smaller alternating double-filtration plant, occupying less land, is required than for the same amount of sewage treated by single filtration.

As an example, the cost of doubling the capacity of the bacteria beds at the Birmingham Tame and Rea Sewage Works near Minworth was estimated at $1,934,400. But it has been decided to install alternating-double filtration costing $350,730.

TABLE I. RESULTS OF TREATMENT OF SETTLED SEWAGE AT MINWORTH, BIRMINGHAM, ENGLAND, BY SINGLE ALTERNATING-DOUBLE FILTRATION

	June 1940–May 1941	June 1941–May 1942	June 1942–May 1943	June 1943–May 1944
Rate of filtration (gal. per cu. yd. per day)				
Single filtration	60–81	78–83	63–84	58–78
Alternating-double filtration	160–163	210–215	241–256	235–244
Biochemical oxygen demand (parts per 100,000)				
Settled sewage	13.0–16.0	10.5–15.0	13.0–17.0	15.0–18.0
Settled effluent from single filter	1.1–1.7	0.9–1.3	0.9–1.4	0.7–1.0
Settled effluents from alterating-double filtration plant				
Primary effluent	1.6–2.1	1.1–2.3	1.7–2.0	1.9–3.5
Secondary effluent	0.9–2.0	0.6–1.2	1.0–1.2	0.9–1.4



PLAN AND ELEVATION of mooring platforms showing spacing and arrangement of the long steel piles driven in soft bay bottom. Mooring platforms are connected by all-concrete trestles 16-ft. wide. The total length is 1500 ft.

Driving 165-Ft. Steel H-Piles

Ben G. Gerwick, Jr.
Ben C. Gerwick, Inc., Contractors
San Francisco

STEEL PILES of the unusual lengths of 152 and 165 ft. had to be driven in the recently completed construction at the San Francisco Naval Shipyard to provide facilities for berthing inactive vessels. The work included building six mooring platforms arranged in pairs about 200 ft. apart and connected by narrow access trestles. Each platform is 60 ft. long and ranges in width from 40 ft. at one end to 52 ft. at the other. These platforms stand in 30 ft. of water, with the furthermost some 1,500 ft. offshore. Each is designed for berthing four large auxiliary vessels, two on each side.

The location—in an exposed portion of San Francisco Bay—is subject to swift tidal currents and strong winds that may come from any direction. The water surface is choppy to rough throughout most of the year. Design of the platforms was based on a wind load of 50 mph. and a four-knot current. Each platform is designed to resist a transverse load of 600,000 lb. and a longitudinal load of 120,000 lb. as well as an H-15 deck loading. These loadings represent the thrust to be expected from moored vessels subjected to combined effect of wind and tidal currents.

Long steel piles needed

Exploratory borings in the vicinity showed the bottom to be mud and mixed clays extending down 150 to 200 ft. below water level. Piles put down for bearing tests indicated that the length of vertical piles to give desired bearing value would range up to 152 ft. The corresponding batter-pile length would be 165 ft.

To meet all requirements it was decided to found each platform on 23 vertical piles, 20 transverse bracing- or batter-piles and eight longitudinal batter-piles. All the bracing piles were driven on a batter of 5 in 12. The piles were designed for a bearing capacity of 40 tons and a pull-up value of not less than 40 tons.

To meet these requirements in bearing capacity and lateral stability it was decided to use 14-in., 73-lb. steel H-piles. The maximum practical length in which these piles could be rolled and delivered was 80 ft., so that it was necessary to weld together two to three sections on the job to make up each pile. Because of the swift, rough water it was impractical to attempt to make a splice in the leads during driving operations. Therefore, all piles were spliced on shore and were transported and driven as a single length.

To maintain true alignment while splicing, piles were laid out on accurately leveled skid ways that were constructed alongside a quay wall at the job site. Sections were then spliced by means of a single "V" butt joint, welded on both sides. While they were on the rack, the top 20 ft. of each pile was cleaned by the flame cleaning process and coated with an asphaltic compound. Completed piles were skidded directly onto a large barge on which they were later towed to the job.

Driving procedure

As no suitable driving equipment was available special assembly had to be made expressly for this job. A derrick barge 140 ft. long, 57 ft. wide and 12 ft. deep, was fitted with a 75-ton, two-drum, diesel-electric derrick with a 95-ft. boom. A steel piledriving frame was set on one end of the barge and equipped with a set of steel pendulum-type leads 100 ft. long. Auxiliary equipment included a large steam boiler and necessary jet pumps.

Driving began with lifting one of the long piles from the delivery barge, using a three-point pickup with two lines from the 95-ft. boom. The pile was then set just outside the pendulum leads where it was held by short outrigger guides of 3-in. pipe.

Since the depth of water at the site was only 30 ft., the longest piles extended some 30 ft. above the top of the 100-ft. leads. The leads were then rotated to the desired batter of 5 in 12. The pile was jetted down until it was under the hammer, the jet discontinued and the pile driven to grade, using a McKierman-Terry No. 11-B-3 pile hammer with an energy

rating of 19,150 ft.-lb. at 95 blows per minute. With this driving rig the average progress was ten piles per 10-hr. shift; best progress for the job was fourteen piles in 10 hr.

Test piles

Specifications required that one vertical pile in each platform be subjected to test. This pile was first driven for a 40-ton bearing, using the following formula in which W = weight of hammer, P = weight of pile (both in pounds), h = normal stroke of ram in inches and S = average penetration of pile in inches for last three blows of hammer:

$$\text{Safe supporting value} = \frac{2Wh}{S + 0.1 \times \frac{P}{W}}$$

After the pile had set for 48 hr. a 40-ton pull-up test was made, using the same derrick with which the pile had been driven. A pulling strap was attached directly to the pile and the 40-ton test load applied. A heavy-duty cable tension indicator attached to a 2-in. dia. cable hooked between the pulling strap and the derrick indicated when the test load was reached. After the test pile had successfully sustained the test load, all other piles in the platform were driven to the same tip elevation, using the procedure described.

The structures were designed by the Bureau of Yards and Docks, United States Navy, Rear Adm. J. J. Manning, chief of the bureau. Capt. W. T. Eckberg was officer in charge of construction. Ben C. Gerwick, Inc., of San Francisco, was general contractor. Jack Lewis was project manager, Wallace Curtis was engineer, William Talbot was field engineer and Howard Harris piledriving superintendent.

Notes on Legal Decisions

Summaries of decisions relating to construction prepared by I. Vernon Werbin, counselor at law and engineer, New York

Reasonable Time For Performance

The rule is well established that where there is no provision in the contract as to the time in which the contract is to be performed, the law implies that it must be performed within a reasonable time. What would be reasonable depends upon the facts and circumstances of each situation, most important being what was contemplated by the parties at the time the contract was made. (Excelsior Mining Co. v. Willson, 178 S. W. (2d) 252).

Waiver Of Rights Under Contracts

A waiver is an intentional abandonment or surrender of a known right or advantage which, but for such waiver, the party would have enjoyed. It is the voluntary act of the party and does not require or depend upon a new contract, new consideration, or an estoppel. It cannot be recalled or expunged. It is essentially a matter of intention. Negligence, oversight or thoughtlessness do not create it.

The intention to relinquish the right or advantage must be proved. Occasionally, it is proved by the express declaration of the party or by undisputed acts or language, so inconsistent with his purpose to stand upon his rights as to leave no opportunity for a reasonable inference to the contrary. Then the waiver is established as a matter of law.

Commonly it is sought to prove waivers by citing declarations, acts and non-feasance. These permit inferences that do not directly, unmistakably or unequivocally establish it. Then it is for the jury to determine from the facts whether or not the intention existed. (Alsens American Portland Cement Works v. Degnon Contracting Co., 222 N. Y. 34)

Mistake in Bidding

A unilateral error does not constitute a basis for avoiding a contract. A party to a contract cannot avoid it on the ground that he has made a mistake. Where there has been no misrepresentation, there is no ambiguity in the terms of the contract, the other party to the contract has no notice of the alleged mistake and acts in perfect good faith, and the bid has been accepted—the bidder who has made the mistake will be bound and must bear the consequences thereof. However, if the party receiving the offer or bid knows or has reason to know, because of the amount of the bid, or otherwise that the bidder has made a mistake, the bidder may void the contract.[1]

In some states there are statutes that provide that in case of bids for state work that: "No bids shall be withdrawn or cancelled until after the contract shall have been awarded."[2] In such cases, once the bid has been submitted, it cannot be withdrawn[3], especially after the bid has been opened.[4]

(1) Seligman, et al. v. United States, 56 F. Supp. 505.
(2) Section 14, New York State Building Law.
(3) Gregory Ferend Co. v. State, 251 App. Div. 13 295 N.Y.S. 715.
(4) Bailey v. Carter, 200 S.W. 2nd, 313.

Acceptance of Last Payment

Where the contract so provides, the acceptance of the last payment thereunder acts as a release of all claims arising out of the contract. Where the contract is with some government authority, any reservation of claims in a general release is ineffective to reserve the right to prosecute the claims after the acceptance of the last payment.

No new rights can be created by the execution of a general release. Nothing short of a modification of the contract or a waiver of its provisions, will avoid the effect of accepting the last payment [1].

A contract provision making the acceptance of the last payment a release of all claims under the contract does not bar an action for damages for breach of the contract after the acceptance of such payment [2]. But, the language of the provision may be so broad and comprehensive as to bar action for breach of contract after the acceptance of the last payment [3].

False and fraudulent representations are not extinguished by the consummation of the contract. They may serve as a basis for setting aside the contract in its entirety or form the basis for extra work payment, not included in the contract [4].

(1) Oakhill Contracting Co. v. City of New York, 262 App.Div. 530, 30 N.Y.S. (2d) 567.
(2) St. George Paving Corp. v. City of New York, 17 N.Y.S. (2d) 540.
(3) Cauldwell-Wingate Co. v. City of New York, 269 N.Y. 530, 199 NE. 524.
(4) Jarcho Bros. Inc. v. State of New York, 179 Misc. 795, 39 N.Y.S. (2d) 867; Frank Nordone Contracting Co., Inc. v. City of New York, 59 N.Y.S. (2d) 256, 269 App. Div. 1035.

SPECIAL HIGHWAY SECTION

THIS ISSUE of Engineering News-Record will reach our readers at a time when many of them will be turning their attention to the Road Show in Chicago and to the concurrent meetings of the American Road Builders Association that are to be held there.

Mindful as they must be of the nation's pressing and unsatisfied highway needs, they will approach this period with a special sense of responsibility toward their jobs and an inquiring and open mind for everything new and significant. In consequence this special section presents a series of articles conceived on that plane of service and devoted to those highway design and construction problems whose solution seems most likely to answer the challenge of the times.

What are those problems? Outstanding, of course, is the one of cost saving, to which wiser and wider use of roadbuilding equipment can contribute so much. Coupled with better specifications, directed toward minimizing handwork, using local materials and eliminating unnecessary refinements, such an attack on costs holds much promise.

Then there is the problem of secondary road construction to which, in view of the growing mileage involved, large-scale construction technique must soon be applied.

In the design field, pavement slabs and surfaces require the benefit of new thinking, as does the subject of highway intersections, which has been attacked with both success and failure in the two decades since the first "cloverleafs" were built. Even location surveys need to respond to a new tempo, and the possibilities of aerial mapping in meeting this need points to new methods with which every highway engineer should be familiar.

All these problems are discussed and analyzed in the pages that follow through articles focused on the best practices that a nationwide search could uncover. To them is added a 32-page section devoted to new equipment to be shown at the Road Show. For those fortunate enough to attend, this preview should be an aid in determining what to see at the show; for those who will stay at home it is a road show in print.

The nation needs roads more than it needs any other public facility. This special section of Engineering News-Record is dedicated to the proposition that the roadbuilding fraternity must be ready and able to build them by the most advanced and efficient methods that its collective mind and effort can devise.

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Possible Cuts in Highway Costs

Comparison of today's costs of highway construction with those prevailing before the war shows a pressing need for unified action by the road-building fraternity to stretch each highway dollar to its limit in providing new highways and rebuilding old ones.

With wages and material prices continuing upward, increased emphasis is being placed on the need for offsetting these rising labor and material costs by means that are more directly within the control of engineers and contractors.

To that end the editors of *Engineering News-Record* asked a number of contractors and engineers for their opinions as to where further economies can be obtained in highway building without sacrifice of quality. Their statements follow. As was to be expected, a divergence of views is found on some proposals for cutting costs, but in general there is agreement that further economies are possible through more mechanization of highway construction and more efficient use of construction equipment, through greater flexibility in specifications to permit more effective use of local materials, and through elimination of refinements such as hand-rubbing of concrete.

Highway engineers will find a subject calling for thoughtful consideration in Morris E. DeWitt's emphasis on the importance of specifying results, not methods, thus giving contractors more opportunity to demonstrate their skill in reducing costs.

Similarly, contractors will find a challenge in J. S. Bright's observation that the highway contracting group appears to be working so near to capacity as to make close figuring on bids unnecessary. This condition, Mr. Bright says, raises question as to whether money could be saved by resort to force account operations for some types of highway work—Editors.

More Mechanization is Best Bet For Cutting Construction Costs

Dwight W. Winkleman
President, The Associated General Contractors of America, Washington, D. C.

GREATER use of modern machinery is one of the keys to greater efficiency and economy in all kinds of construction operations. Studies have shown that construction costs are in line with the prices of other commodities and services. In fact, they have lagged somewhat behind the general trend of the economy.

But if the construction industry is to have a prosperous future it must continue to give the public greater value for its investment. One way to achieve this is through increased mechanization.

In the future I hope that there can be more cooperation between equipment manufacturers in the development of improved machinery and methods; more cooperation between distributors and contractors in the maintenance of equipment; and more cooperation between engineers and contractors in the design and supervision of projects so that the maximum potentials of new machinery can be realized on the job. This will enable our industry to serve the public better.

Developing new equipment

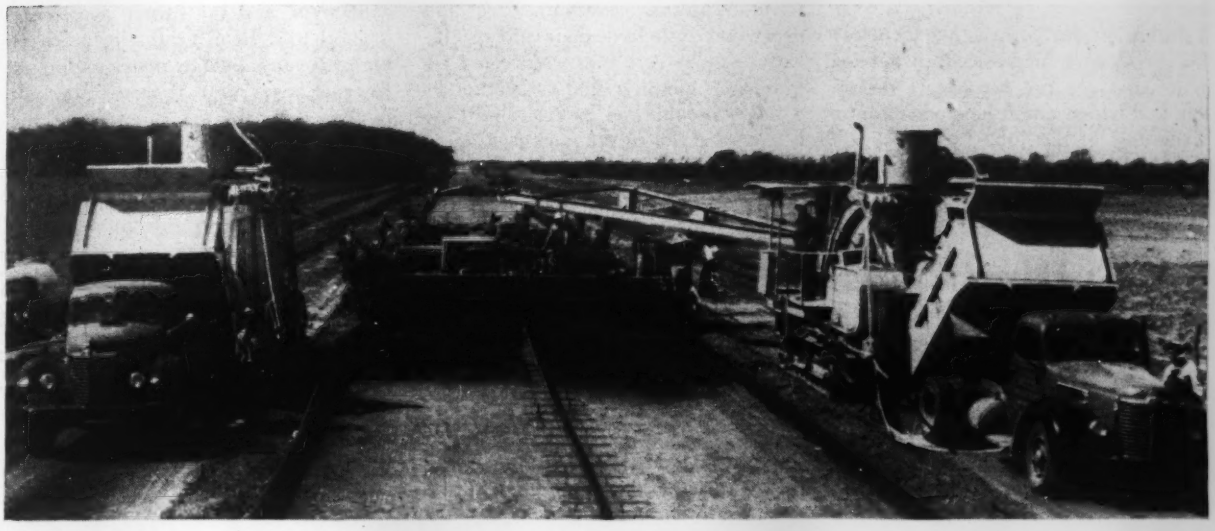
Many contractors have worked with equipment manufacturers in the design and development of new and improved equipment. By working closely together, new ideas can be tested to fit the conditions encountered on the job itself; or new conditions are found that suggest a new type of machine.

This is a field in which much more work could be done. I look forward to the time when equipment manufacturers and contractors will have an organized means of working cooperatively on the design and development of even more improved equipment.

Most contractors, I believe, are learning not only that the purchase of modern equipment leads to savings in costs, but also that systematic maintenance and prompt repair pays substantial dividends in operating costs. Much work along this line is being done by contractors in cooperation with their equipment distributors. The recently established Joint Cooperative Committee between the Associated Equipment Distributors and the Associated General Contractors of America is proving helpful in formulating policies for the efficient handling of this work.

A contractor, however, cannot take full advantage of the economies possible unless projects are properly designed. Some of the most important work being undertaken currently in the field of design to permit increased mechanization is by the Joint Cooperative Committee of the American Association of State Highway Officials and the AGC

At meetings held in various parts



ECONOMY through mass production is obtained on highway work. These two 34-E dual-drum pavers were able to lay 200 ft. of 22-ft. wide, 9-in. pavement per hour in Kansas.

of the country every few months highway officials and contractors have had the opportunity to talk out the problem of how to design projects so that contractors can build them with increasing efficiency. The work of this national joint committee has stimulated similar work in the states. In a number of states the highway departments have called in committees from AGC chapters to give a thorough study to revising the state's specifications.

Recently I had the opportunity of discussing this problem at meetings of the Construction Division of the American Society of Civil Engineers. Members of the division evidenced a growing realization of the importance of eliminating unnecessary items from plans and specifications, and of giving greater attention to costs in design work.

Among the many questions being discussed jointly by contractors and engineers are standardization of design to eliminate as much unnecessary work as possible, and getting design engineers onto construction jobs where they can become familiar at first hand with mechanized methods.

The important fact, it seems to me, is that there is a growing realization throughout the industry that the costs of all types of construction operations must be cut without sacrificing quality so that the public continues to receive more value for its investment in construction.

Three Cost-Cutting Tips From Texas

D. C. Greer
State Highway Engineer of Texas
Austin, Tex.

It certainly is my belief that each and every engineer in the country today is endeavoring to the very best of his ability to secure the greatest value from each dollar spent in the road-building industry. There are various methods of attacking this problem, but I should like to dwell particularly on three possibilities.

One of the most productive methods of securing greater value from the road dollar in the bridge or structure field, under present conditions, has been to prepare designs that permit forms to be utilized over and over again, for both substructures and superstructures. The reuse of forms without expensive rebuilding certainly constitutes a saving to the contractor and he, in turn, should pass this saving on to whatever state highway department is involved.

The second factor that is basic but which ofttimes is overlooked is the maximum utilization of available local materials. By this I do not mean merely local gravel or base-course materials. There are unlimited possibilities of utilizing materials that might be available on or near a construction project, even though their use might not be completely orthodox.

It seems to me that under present price conditions the utilization of local materials to the fullest possible degree should challenge the ability of each and every highway engineer in the country. By local materials one also should consider those within the boundaries of the county or the state, provided the engineer is assured that he is securing the best buy for the available money.

Eliminate non-essentials

The third factor ties in rather directly to the factor just mentioned. It is the zeal of the engineer to secure absolute perfection in his construction. This is an admirable characteristic and one that should be cherished by all members of the engineering fraternity. Nevertheless, under present construction conditions and costs, some of our designs and requirements are what I might term "painfully right". No one would question whether or not we were right from an engineering point of view. Neverthe-

less, we might be placing a construction requirement or imposing a type of design on our contractors or material producers necessitating refinements that are not absolutely necessary and which add a heavy premium to the cost of the job.

Possibly five years ago such requirements might have cost little, if any, premium. Nevertheless, today we should carefully examine each and every one of these designs and specifications to be sure that we are not requiring something that is costing us a lot of money and at the same time is not essential to the construction of the project for the benefit of the traveling public.

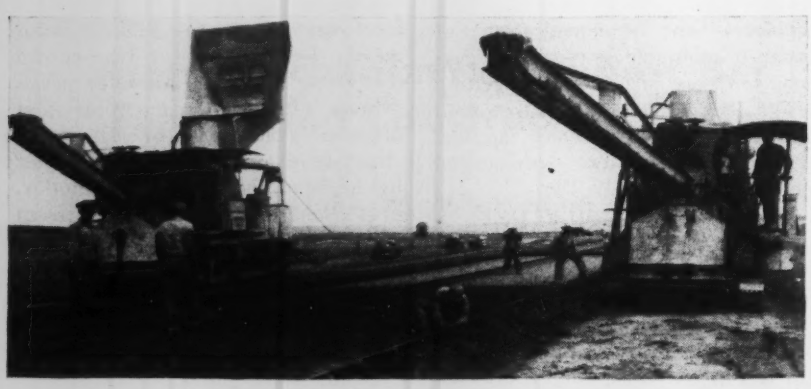
Cutting Costs in the Midwest

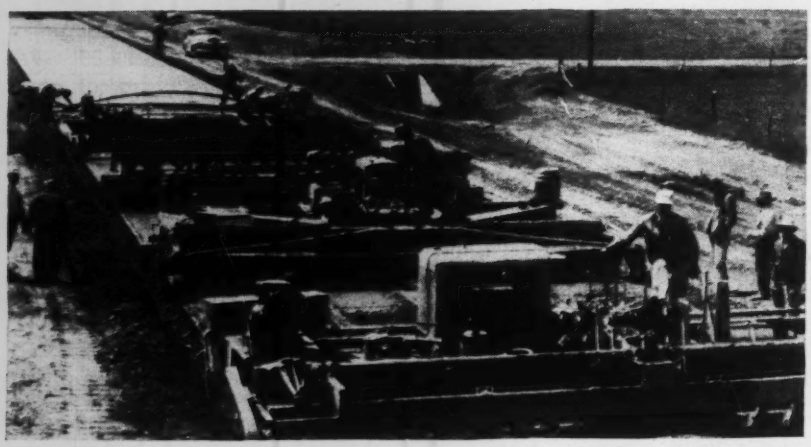
George C. Koss
President, Koss Construction Co.
Des Moines, Iowa

Some measure of what is being done to reduce the cost of both highway and bridge construction in the midwestern states west of the Mississippi river may be gained from a brief report on our experiences in Iowa, Kansas and Missouri. The cost of performing highway and bridge contract work is, of course, definitely related to the price of general commodities, labor, and transportation. Since the contractor does not control the costs of these items his bid prices cannot help but reflect the general price trends.

The big question, in my mind, is whether construction bid prices have been higher or lower than the general price level. If they are higher, then the owner and the contractor are doing a poor job. If they are lower, the contractor and the owner are doing a good job. In general, the price of highway and bridge construction in Iowa, Kansas and Missouri has not increased to the same extent as the general price level. It follows, therefore, that the state highway commissions and the contractors actually have done a good job in reducing construction costs.

First, I would give credit for this condition to the joint meeting and discussions held between the Highway Division of the Associated General Contractors of America, the American Association of State Highway Officials and the Public Roads Administration. Specifications have been revised from suggestions originating with both the owners and the contractors. Restrictions on size of equipment have been eliminated, methods of curing have been changed, rubbing of unexposed concrete surfaces has been eliminated, and hand finishing has been greatly reduced.





A LARGE INVESTMENT in construction equipment is required of contractors if unit costs are to be reduced.

Two pavers per crew

Our own company has found it more profitable to use 34-E dual-drum pavers exclusively and, whenever possible, we use two such pavers with each crew. Each outfit has mechanical subgraders, concrete spreaders, diagonal screed finishers and longitudinal finishers. Form pins are pneumatically driven, and the road rails are loaded with truck-mounted winches. Wherever possible, subbase material is moved and placed with self-loading scrapers. In brief, we like to think of our paving operation as being nothing more than a straight manufacturing operation. Our gage of efficiency is the average number of batches placed per hour.

Increased mechanization by paving and grading contractors to achieve greater production and reduce cost, creates a problem in itself. The contractor immediately increases his capital investment to the point where depreciation becomes a major cost item. The shorter the working season the larger this item per square yard or cubic yard becomes. Likewise, time lost in moving from one job to another reduces the productiveness of the contractor's equipment.

For example, assume the elapsed time between completing the paving on one job and starting the paving

on the next job is two weeks. Therefore, to move on and off the same job requires four weeks. The production thus lost at a rate of 20,000 sq. yd. of concrete pavement per week is 80,000 sq. yd. Solely from the viewpoint of production the attractiveness of a 100,000 sq. yd. job over one involving 50,000 sq. yd. is apparent.

From the same viewpoint, rural work is more attractive than urban work with its unavoidable delays. The highly mechanized contractor cannot help but ask himself when preparing a bid, "How much potential production will I lose by building a low yardage job or an urban job?"

Even more important than the consideration of equipment is that of personnel and organization. The twelve-month employment of key men is a highly productive investment. But to be a productive and profitable investment, the contractor must have uninterrupted work over as long a working season as is physically possible.

And, finally, I believe that the letting of larger projects for grading and paving is necessary if the construction industry is to be able to swim against the tide of high commodity prices. A cubic yard of dirt, a cubic yard of bridge concrete, and a square yard of pavement are today's best buy.

Fewer Restrictions on Initiative Will Reduce Road Costs

Morris E. DeWitt
Porter-DeWitt Construction Co.
Poplar Bluff, Mo.

Construction costs have not increased as much as the other costs according to several reliable agencies making statistical analyses. But this does not absolve constructors and engineers from their duty of making the highway dollar go farther. Reducing costs of public facilities is the primary justification for the very existence of the contracting business.

Competition continues to be the force that fosters efficiency by the development of initiative, ingenuity and industry to the greatest degree. It is inherent in the contract system of doing work, and maintenance of competition must be the first aim of those agencies proposing to build, and of those interested in the perpetuation of the contracting business.

It can be assumed that anyone established in business is anxious to obtain work for his plant and organization. If bids are not received on a project, obviously there are factors that make the offering unattractive or unprofitable, and these should be explored. A contracting agency must exert extra effort to make its work desirable, particularly when sufficient work is being offered to allow prospective bidders a wide choice of work.

Perhaps bidding is discouraged by the constant rejection of proposals made by reliable and experienced contractors. Possibly a contractor's experience with an agency has convinced him that all possible assistance will not be given to expedite the early completion of a project at the lowest cost.

Technicalities or unnecessary refinements required in previous work may have retarded progress without adding anything in quality or service to the finished product. Ambiguity of specifications, or requirements that make the source of acceptable materials questionable may cause the work to appear unusually difficult or hazardous.

Perhaps a short completion date penalizes the job by causing too great a concentration of equipment for the volume of work involved. Payment for previous construction may not have been prompt, or final acceptance and payment for a completed project were unduly delayed.

In some instances a contractor's risk due to unbalanced quantities, lack of adequate engineering exploration, or failure to furnish sufficient and reliable information, make the project less desirable. Perhaps a better time might be picked to offer the work for contract, either by reason of seasonal considerations, other going projects, peculiar labor or material conditions, and the like.

Larger contracts needed

Failures in all lines of business following a period of high business activity tend to prove that this is an inopportune time for the small operator to engage in new ventures. Today there are a greater number of substantial contractors whose operations have expanded during the past few years. They are equipped and have organizations experienced in handling larger projects on which mass production methods were developed. Consequently, it seems that the balance might be in favor of larger projects rather than in splitting the work into units to encourage more individual contractors. Discrimination in contract offerings certainly is indicated according to local or regional conditions.

It has been emphasized from many sources that curtailment of hand operations will save large sums without affecting the stability or use of the facility. It might be added that workmen themselves will not prosecute a task industriously if it offers no reward—in spite of pay or supervision, they merely hang on to the shovel or pick if the result is seemingly of little value. The leveling down of individual effort can be offset partly by greater consideration of the individual and by more personal contact with workmen to increase their pride of craft and loyalty to their employer. Perhaps some of our supervision methods are outmoded.

Standardization of structures and of the entire design of a highway will aid in attaining greater efficiency from both hand labor and machine work. It also will effect economies in materials and supplies.

Results, not methods, must be the aim of engineers. If the high efficiency of the contract system is to be realized, the contractor must have full opportunity to apply his ingenuity in devising and developing new and better methods and to profit thereby. Machines will be developed and contractors can be depended upon to use them, when and if there is an opportunity for extra compensation. A contractor tied down by specified methods and machinery for an operation has no opportunity to perform his

primary function most effectively. Job inspection may limit this to as great a degree as do some written specifications.

Next to labor, equipment repair is the largest item in percentage of cost on a project. The depreciation portion of it is not readily determined until the machine has been worn out, has become obsolete, or has been disposed of by sale or otherwise. Varying estimates of the cost of ownership are often the primary difference in contractors' proposals.

Equipment costs underestimated

Many contractors probably underestimate equipment costs and submit proposals that are too low because of their failure to take present conditions into account. Those depreciating equipment on an original cost basis, and perhaps paying tax on profits so computed will, in effect, lose one-half their tools when it comes to replacement. Replacement costs today are double those of the original cost.

The cost of operation and repair of equipment on the project lends itself to economies that may have been overlooked or neglected during the past few years when proper maintenance was most difficult because labor was scarce and repair parts not readily available.

The cost of general expense items, supplies, small tools, sanitary water facilities, ice, telephone, etc., has increased percentagewise. The cost of commodities and services has gone up out of all proportion to total construction cost, and thus has become an important factor. The custom of buying without regard to cost simply because the item is available is no longer in order. Anticipation of needs far enough ahead to allow some shopping will save money in today's market.

The contracting business will find survival most difficult if it cannot submit firm prices for its product. Continued refusal by manufacturers of basic materials to adopt a price policy consistent with the best interests of the construction industry is a matter that demands action on the part of individuals and groups of contractors. The Associated General Contractors of America has taken a positive stand on this issue at several meetings during the past year. Its action will produce beneficial results only if followed by the individuals making the actual purchase.

Lower costs through greater safety

As labor costs increase, savings to be made by intelligent accident prevention work becomes more and more important in the final cost of the work. It would seem that a unit of work should be the measure of accident exposure rather than dollar value. Insurance rates are increasing, however, due to the larger benefits provided by workmen's compensation and to increased operating costs.

Construction and reconstruction of highways is urgently needed. The market price, or the fair, reasonable price, is established by the lowest proposal from a responsible and experienced contractor bidding against others who want the work. The analysis or breakdown of that price into its component parts by anyone other than the person whose money is being risked to execute the work, will not change the market price.

Savings in Costs Result From Encouraging Specialization

R. C. Keeling
Kansas State Highway Engineer
Topeka, Kan.

Kansas has been letting contracts for highway construction since the end of the war as fast as surveys and plans could be completed and rights-of-way secured. The highway commission has proceeded on the assumption that prices were not going to decrease materially in the near future, that construction and reconstruction was needed badly on the highways and that available funds, therefore, would serve the public better through the completion of highway projects rather than postponing needed work in the hope that construction costs would decline.

Extensive study has been given to possible measures that would reduce our construction costs. We are standardizing our bridge plans as much as possible in order to simplify formwork, thereby reducing the amount of labor and allowing greater reuse of form lumber. Due to the shortage of structural steel we are using concrete designs and eliminating H-piling and steel sheetpiling wherever possible. On grading projects hauls are being kept as short as possible, ditches are designed of widths suitable for heavy modern equipment operation, and less finishing is required in the field.

Stabilized bases and bituminous mats are being designed to allow the use of all local materials possible, thus eliminating the shipping in of large amounts of materials. We are letting larger projects on our state highway system than before the war, which makes them more attractive to the contractors and allows lower unit costs.

Another policy this state has always followed is to take bids separately on bridges, grading and surfacing, thereby allowing those contractors specializing in a particular type of work to bid that work and not have to subcontract from a general contractor. We believe this makes for lower bid prices and allows small contractors to get into the contracting business and develop efficient organizations. As they complete more and more contracts this allows them to expand.

Small contractor encouraged

We have had very keen competition among our contractors and have encouraged small contracting organizations to pre-qualify so as to bid on our highway work. This has been especially helpful in our secondary road program since many projects on our secondary system are too small to be attractive to the larger contractors. We expect a number of these smaller organizations to develop so as to be able to bid on larger projects. Out-of-state contractors also are encouraged to pre-qualify in this state.

Our contractors are, in general, building up their equipment and personnel, and as they become better equipped, they are giving the state the

MECHANIZATION of earth moving has helped materially in keeping grading costs on highway construction from going up as fast as some other items.

advantage of more efficient operation. Every effort is made by them to reduce the amount of common labor used on their projects, due to its price, scarcity and low efficiency at the present time.

A weighted average of all types of highway construction in our 1946 program showed an increase of 61.4 percent over 1940 costs. A similar comparison for 1947 shows an increase of 75.8 percent over 1940. Highway construction costs in 1940 in this state were exceptionally low and, although our percentage increases in 1946 and 1947 are high, we believe that present costs probably are lower than the national average.

Specifying Results, Not Methods Will Cut Construction Costs

Leet M. Denton
Denton Construction Company
Detroit, Mich.

Highway construction costs in Michigan are not unreasonably high. This is attributed to a combination of factors, chief of which is keen competition among the large number of highway contractors. We have sensible, understandable construction specifications and we are furnished with adequate plans.

Our state highway department makes an honest effort to see the contractors' problems. We understand exactly what is expected and, knowing all these factors to be certain, we can bid intelligently. Furthermore, we must bid reasonably to get the job.

In considering the question of reducing highway construction costs, full cognizance must be taken of the inflationary forces now at work. Yet, while many intelligent people recognize and admit the rising costs of almost everything else, they cannot seem to condone current construction costs. We contractors are no different than other businessmen. We are striving to keep our heads above water and are having a hard time of it, with rising material and labor costs. We have actually held the line better than most industries, yet possibly we can improve.

Equipment maintenance important

What to do about it? A careful, sensible look at the situation will show that many things can be done. First, Mr. Contractor, sit back and take a good look at your outfit. Is it as efficient as it can be? Do you have the best equipment for the job? Is your equipment well maintained or is it repaired just "good enough" to get by? Proper maintenance of equipment is one of the most important steps in lowering operating costs. I know because I have tried both ways. Insist on good maintenance and buy the best equipment available and you will profit.

Secondly, how efficient is your personnel? We all try to get the best men possible, but do we always hire the best that is available? Do we not more often take the first man that comes along? Use every precaution in selecting your men and it will lead to lower costs.

Recently I spent some time acting on a specification committee appointed by our local contractor association to review specifications with the Michigan State Highway Department. A new standard book of specifications was being written and we were given the opportunity to review all proposed changes. We were well received by the highway department and I must say that its staff had an open mind to all our suggestions.

As a result of the work done by this committee I arrived at some very definite conclusions on how to reduce highway and bridge costs.

Specify results not methods

The contractor should be left free to develop new methods that accomplish the desired result more efficiently. With the increased use of new and improved machinery, many ingenious methods can and will be developed by the contractor. His should be the responsibility of securing the required results, without being hampered by restrictive methods of construction.

Design engineers and specification writers should become more familiar with actual field operations. They should see the jobs under construction and talk with those who use their plans and specifications.

Rights-of-way should be acquired promptly. This has long been a sorry situation. Every effort should be made to clear the right-of-way for the contractor so that he can efficiently perform his work.

The moving of public utility poles and the adjustment and rebuilding of underground structures by the utility companies should receive the strict attention of the highway department.

In many cases hand-trimming of

ditches and slopes can be eliminated, resulting in lower cost. The finishing of ditches and slopes by machinery should be considered. Hand rubbing of concrete structures also should be eliminated where possible.

Pipe culverts should be substituted for concrete box culverts where feasible. We suggest more standardization of box culvert design. We also suggest the use of pipe culverts up to 72-in. dia. With today's high labor cost sodding should be eliminated wherever possible.

Small quantities of bituminous pavement in areas far removed from asphalt plants should not be specified. A more simplified specification should be developed for bituminous pavement on bridge approaches so that this material can be made locally. Concrete curb which is very expensive to build today, should be left out wherever possible.

Need standardization of wire mesh

Attention is called to current specifications on wire mesh reinforcement and to a needed review of its design. In this country today, there are over 23 different types of wire mesh specified by the various highway departments. Standardization of this reinforcement should be considered so that it can be manufactured more economically.

Lack of Real Competition Results in Higher Bids

J. S. Bright
Deputy Commissioner,
Public Roads Administration
Washington, D. C.

With highway construction costs now more than 100 percent above the 1940 level, a pertinent question is: Will we be able to meet even the minimum need for highway improvements if prices continue to rise?

Closer cooperation between the equipment manufacturer, the contractor and the highway engineer will contribute to the progress of the program by speeding up equipment modernization. Since the engineers are responsible for the specifications which the contractors follow in building the highway, and since the manufacturers furnish the equipment needed for the job, it is important that the three groups work together. Improved equipment will greatly reduce the cost of highway construction.

Motorized equipment and the rate at which its use is expanded are important factors in the reduction of construction costs. By producing machinery adapted to the needs of today's road builders, manufacturers can contribute materially to the progress of the highway program.

Road construction has been seriously handicapped since the war by shortages of machinery. Some of the important items still in short supply are power shovels, tractors and graders. Highway work cannot move ahead much faster than the rate at which the equipment industry supplies its contractor-customers with replacements and repair parts.

Operating near to capacity

While shortages of equipment are a contributing factor, current high prices can be traced more directly to conditions existing within the contracting industry itself. In the first place, there are strong indications that the industry is operating to capacity. During the past year, in many instances, no bids at all were received for advertised projects, or the number of bids was so small that there was little or no competition. The large number of contract offerings for which there was little competition suggests that we have reached the optimum rate of offerings in relation to construction capacity.

Further evidence that contractors are being offered more work than they can perform efficiently under existing conditions is found in the fact that a large amount of highway work is behind schedule. Of the total number of federal-aid projects completed during the past two years, 40 percent ran over the contract time.

Unsatisfactory progress on highway projects was attributed to shortages of material, labor and equipment, weather conditions, and miscellaneous causes. But the major factor was reported to be some shortcoming of management.

Evidence of poor management

Poor management—failure to start the work on time and failure to push the work—was reported as the direct cause or a contributing cause of delays on 31 percent of the projects behind schedule.

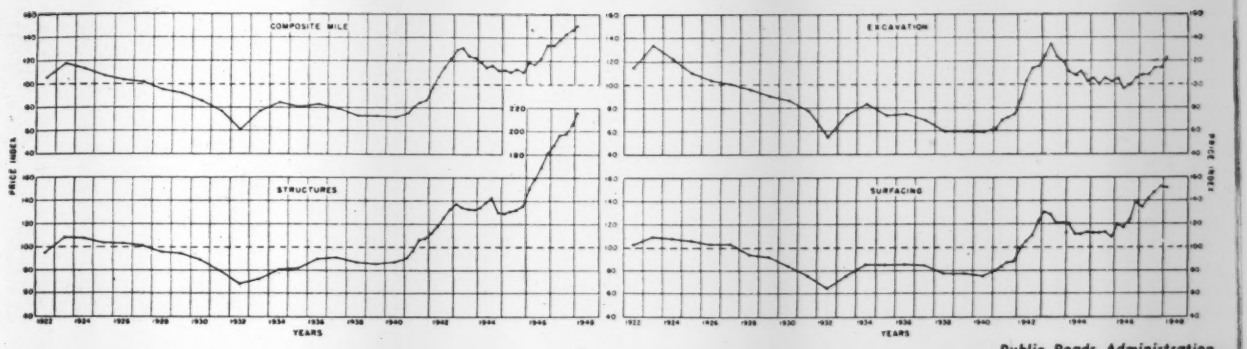
In some instances what appears to the inspecting engineer to be inefficient management may not in fact be inefficient management from the contractor's point of view. Other conditions often are the actual cause of delays. It is significant, however, that a check of unsatisfactory progress on projects reported for September, 1947, in widely separated states, revealed that more than half of the contractors behind schedule had two or more contracts. One contractor had a total of 14 projects under way, with 10 of them behind schedule.

On the basis of these reports it is logical to assume that the real reason for unsatisfactory progress, when attributed by the engineer to management, is that the individual contractor had been awarded more work than his organization could handle efficiently.

Bids not figured closely

Another cause of high prices are the methods employed by some contractors in preparing their bids. Under present conditions, with little competition and the prospect of a big construction program, many contractors think it is not necessary to figure a job closely in order to obtain work; especially at the start of the construction season. Instead, they are tempted to bid whatever the traffic will bear by adding a large contingent item to cover unpredictable costs and ineffective management practices.

Contractors insist they are doing their utmost to hold construction costs in line. The incentive to cut costs is lacking due to prevailing high prices now obtainable. Efforts in this direction appear sometimes to be



Public Roads Administration

HIGHWAY COSTS continue to rise. The only encouraging sign in the price trend charts for the PRA composite mile is the slight decline in surfacing costs recorded early this year.

confined to an attempt to persuade the engineer to relax specification requirements. We should be alert to see that the allegedly obnoxious contract clause, "as the engineer may direct," is not revised to read: "as the contractor may elect." A certain amount of flexibility in the contract is desirable to permit the utilization of new construction techniques and the use of improved types of equipment, but the privilege should not be abused.

Conditions in the labor market also have pushed prices up. Experienced equipment operators not only are hard to find, but they are reluctant to move around from one section to another as they did in prewar days. They realize it no longer is necessary to travel far to obtain steady employment; furthermore, living expenses away from home are unpredictable and high.

Skilled labor, as well as unskilled labor in some areas, now demands and receives straight pay for a full day even though the individual employee may work only one or two hours in any one day. In some sections, shovel operators must be guaranteed a full week's pay if they work any part of a week. Since these labor practices increase operating costs, the contractor naturally feels that the contingency item in his bid should be large enough to protect him against possible idle-time labor expenses.

We are fully aware of the difficulties under which the contracting industry is operating, and we readily admit that reasonable protection against unpredictable contingencies is justifiable. On the other hand, the widespread practice of pyramiding remotely contingent factors on top of normal and anticipated contingencies to provide an adequate "cushion" is one of the causes of present high prices. Deliberate inflation of contract prices, motivated by the knowledge that competition will not be keen, removes all risk from bidding. Without an element of risk, competitive bidding is meaningless.

Despite the large volume of work to be done, there is evidence that many contractors do not welcome the advent of new competitors. Out-of-state contractors are discouraged in various ways from entering a state to bid against "local" contractors and even contractors within the state are very cautious about bidding in certain areas within their own states. They have greater difficulty than the local, established contractors do in obtaining critical materials, equipment and spare parts. Time and again, only one or two bids are received for large urban projects. Unless this situation improves, we shall be inclined to lend greater credence to the rumor that local "tie-ups" are so strong that outside contractors do not dare to bid in certain areas.

Trend is toward force-account work

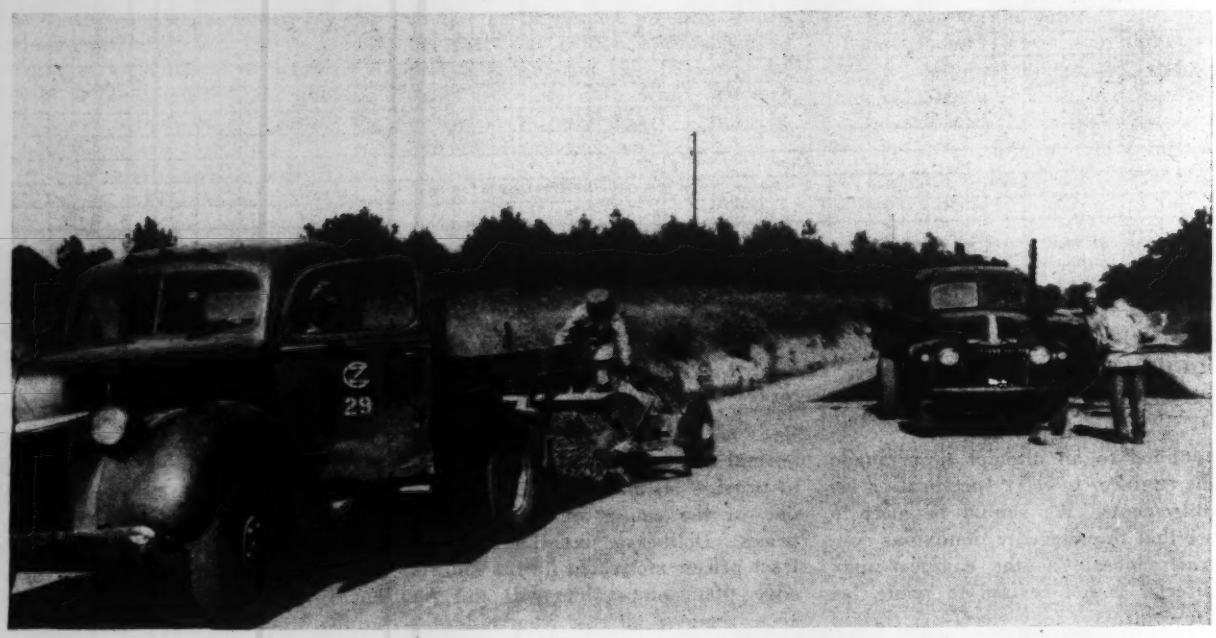
The Public Roads Administration is convinced of the economy and efficiency of the contract system, based upon adequate competition. It is significant that in 1947 only $5,193,000 worth of road work, or less than one percent of the total, was approved for force-account on federal-aid projects, as compared with 18 percent on non-federal-aid projects reported by state highway departments. However, if contract prices continue to rise, it may be expedient to resort to force-account on a larger scale for grading and many other types of road work which local authorities are equipped to undertake.

In order to stretch the highway dollar as far as it will go under present conditions, the Public Roads Administration has urged state highway departments to establish three primary prerequisites as a basis for making contract rewards. These are: (1) The improvement must be urgent in character; (2) there must be adequate competition in bidding, and (3) the unit bid prices must be justified by proper engineering analyses.

It is essential that urgently needed projects be constructed on a statewide priority basis to avoid their subsequent elimination from the program because of a shortage of funds resulting from an excess of contract awards for less important projects.

When there is adequate competition in bidding, it is obvious that contractors who are sincerely interested in getting a job will consistently submit a reasonable bid that has been closely figured, with a reasonable allowance for contingencies.

The third point, justification of unit bid prices, calls for establishment of firm engineering estimates in advance of bid openings. The tendency to gamble or "cushion" bids because of unforeseen contingencies can be eliminated to some extent by awarding short term contracts or contracts restricted to the type of work best suited to the contractor's organization and equipment. Several states have obtained favorable prices on structures by receiving bids for furnishing and fabricating steel and subsequently inviting bids for erection when delivery of material was assured.



A ROTARY BROOM is used to remove loose material from the stabilized base before the prime coat is applied.

Base Stabilization Widely Used On North Carolina Secondary Roads

GREAT EMPHASIS is being placed on the improvement of secondary roads by the North Carolina State Highway and Public Works Commission. Between the end of the war and July 1, 1948, that department will have spent about $90,000,000 on highway improvements and of this amount nearly $55,000,000 will have been utilized for projects on the state's 50,000-mile secondary system. Over 1,000 miles of that system were hard-surfaced during the 1946 calendar year, 1,200 to 1,400 miles were paved with bituminous materials in 1947, and about the same mileage is programmed for 1948.

During the 1946 construction season, extensive secondary mileage was improved by construction of a six-inch soil-cement base and adding a sand-asphalt top or bituminous surface treatment, as described in *Engineering News-Record*, April 3, 1947, vol. p. 498. Almost all of this work was done by contract.

In addition, during 1946 state forces stabilized some natural soil bases, mostly clays, by mixing crushed stone screenings or sand with the local material and then adding a bituminous surface treatment. No projects calling for this type of stabilization were done by contract in 1946 because it was felt that contract work would not permit the close control needed to obtain desired results in stabilizing the base. However, in order to expedite the 1947 secondary program, a number of contracts were awarded calling for this type of stabilization followed by surface treatment. Methods developed have produced good results with these contracts, and the department plans to award much similar work in 1948.

Most of the secondary roads being paved carry over 300 vehicles per day, with a greater volume anticipated once the current work has been completed. However, a limited mileage carrying about 100 vehicles daily is being stabilized and surfaced.

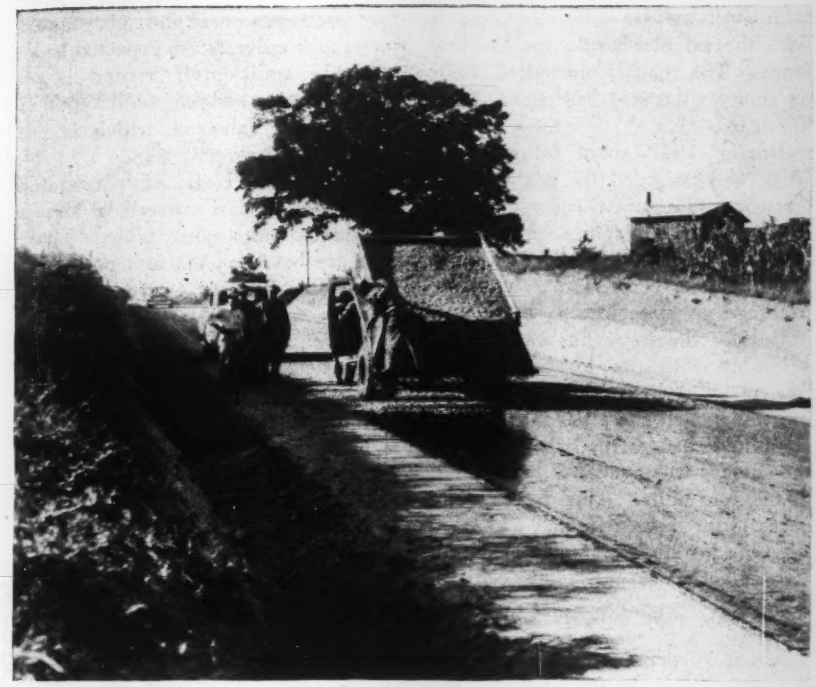
Built to good standards

Although every attempt is made to follow the old road to reduce right-of-way and grading costs, standards for the construction of the paved secondaries are considered fairly high. In flat and rolling country the steepest grade is limited to about 6 percent with a maximum of 8 percent, and the

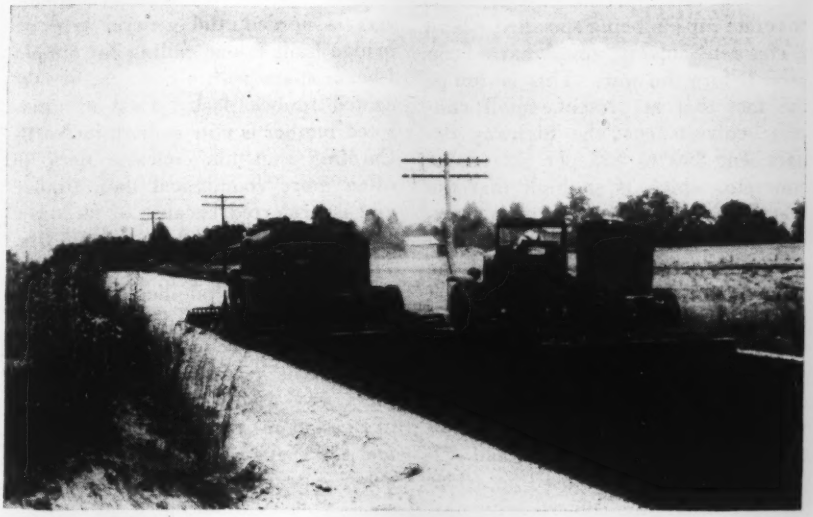
COMPARATIVE COSTS OF CONCRETE AND METAL PIPE CULVERTS

Average cost per lin. ft. in place of several thousand precast concrete and corrugated metal culverts built by North Carolina by contract between January 1946 and December 1947:

Diameter	*Concrete*	*Metal*
15 in.	$2.25	$2.42
18 "	3.05	3.11
24 "	4.57	4.44
30 "	6.67	6.10
36 "	8.63	8.20
42 "	11.50	10.04
48 "	14.76	13.06
54 "	18.12	16.67
60 "	21.30	17.93
66 "	25.64	20.56
72 "	34.00	24.67



STONE at the rate of 42 lb. per sq. yd. is applied to the surface following an application of about 0.7 gal. of asphalt per square yard to the base. Rolling of the stone follows closely behind.



ASPHALT is applied to the last layer of stone at a rate of 0.2 gal. per sq. yd., after which broom drags make several passes before final rolling.

sharpest horizontal curve is usually 6 deg. Sight distances are generally good. In mountainous terrain the standards as to alignment and grade are reduced somewhat to avoid prohibitive costs.

The paved surface on all of the mileage being improved is made at least 18 ft. wide and more than one-half is built to a 20-ft. width or greater. The base is made 1 ft. wider than the surfacing.

A 6- to 7-in. compacted thickness is usually specified in stabilizing the natural soil base with screenings or sand. To determine the desired amount of stabilizing material to be added, the department's soils laboratory takes extensive samples along the project. It then specifies the amount of material needed for various sections of the project—on most projects the amount of material is changed every few hundred feet. The laboratory also specifies the depth of subgrade soil to be mixed with the stabilizing material to produce the desired thickness of the compacted base. Samples of the treated base are sent to the laboratory during stabilizing operations to determine whether the desired gradation of the mixed base is being obtained. These samples are usually taken at 500-ft. intervals.

Clay soils stabilized

The natural soils being stabilized with sand or screenings are primarily clays of the kaolinitic type, as this kind of clay appears to be of a better quality for earth-type base work than other clays. The soils treated are also classified as mostly of the A-4, A-5 and A-5-7 types according to the Public Roads Administration classification, but they do not include A-6 and A-7 soils.

Material considered satisfactory for stabilizing these subgrade soils must meet a gradation about as follows:

Sieve Size	*Percent Passing*
No. 10	80 to 100
No. 40	30 to 60
No. 200	0 to 5

When the stabilizing material and subgrade soils are properly proportioned and mixed, the mix will meet the following general gradation:

Sieve Size	*Percent Passing*
No. 10	90 to 100
No. 40	40 to 75
No. 200	15 to 35

With the soils stabilized, from 50 to 80 percent of the compacted base will be made up of added material, the average being about 70 percent. Generally from 340 to 545 lb. per sq. yd. of the sand or screenings must be added to the base to produce a 7-in. compacted thickness. To simplify the payment procedure, the contractor is paid by the ton for the amount of stabilizing material delivered to the project, and as a separate item he is paid on a square yard basis for processing and compacting the base. The surface treatment payment is handled as still another item, on a square-yard basis.

Before adding the stabilizing material, the subgrade is brought to

proper form with motorized graders and the specified thickness of the soil to be mixed with stone screenings (or sand) is scarified with the grader. The scarified soil is then windrowed along the edges of the road by the same rig, followed by addition of the screenings along the center of the road by truck.

After the screenings have been spread uniformly over the base, the windrowed soil is spread on top of the screening and the materials mixed with disk harrows and rotary mixers of the type used widely on soil-cement construction. Compaction of the base is with both sheepsfoot and pneumatic-tired rollers, water being added to the base by sprinkler trucks as this operation progresses.

Surface treatment follows

As a preliminary to adding the surface treatment, a prime coat consisting of 0.3 gal. per sq. yd. of MC-O asphalt is applied at a temperature of 105 to 120 deg. F. In a few days this is followed by 0.4 gal. per sq. yd. of 150 to 200 penetration asphalt at a temperature of 275 deg. F. and immediately afterward by 42 lb. per sq. yd. of crushed stone or gravel. This stone must meet the following general gradation:

Sieve Size	*Percent Passing*
1½ in.	100
1 in.	95 to 100
¾ in.	30 to 50
½ in.	0 to 10
No. 4	0 to 2
No. 200	0 to 0.5

Rolling with smooth-wheel rollers of 5 to 7 tons in weight follows soon after addition of the stone. About ten days later a drag seal is added to complete the surfacing. This seal consists of 0.2 gal. per sq. yd. of RC-2 at a temperature of 125 to 140 deg. F. plus immediate application of 22 lb. per sq. yd. of stone meeting the following sieve analysis:

Sieve Size	*Percent Passing*
¾ in.	100
½ in.	95 to 100
⅜ in.	75 to 90
No. 4	25 to 50
No. 16	0 to 4
No. 200	0 to 0.5

As soon as the stone has air dried, another 0.2 gal. per sq. yd. of RC-2 is added and the stone thoroughly coated with the asphalt by several passes of a long-base broom drag with steel bristles. Final rolling is with the same roller as for the first stone. The road is opened to traffic as soon as the seal has cured, or in about two days.

During 1947 about 60 miles of work was awarded by general contract, including one thirteen-mile job, calling for stabilization of the base with sand or screenings by the methods just described. Good results were obtained on these jobs.

Cost of the work has varied considerably with the location of the project, the distance the materials must be hauled and other factors. The combined cost for the base work and the surface treatment has been about $9,600 per mile. This figure compares with approximately $12,000 per mile for surface treatment with a soil-cement base.

More pipe culverts built

About 90 percent of the drainage structures now being built by the North Carolina department are located on the secondary system. This work is distinguished by the fact that for many of the smaller openings, concrete pipe is being specified where a concrete culvert would have been used before the war. This is due to the fact that at present, small concrete culverts cost the highway department $50 to $55 per cu. yd. of concrete, which is so high that the installation of pipe culverts is proving much more economical. As a result almost no box culverts of the 3 x 3-ft. size are used, and the smallest now built are generally 5 x 5-ft. and 6 x 4-ft. structures.

Until the war began, few pipe culverts larger than 36-in. in diameter were installed. Now pipes of 54 and 66 in. are fairly common, and 72-in. diameter pipes are used occasionally. Double pipe culverts with pipe as large as 66 in. are frequently built and triple culverts using this size of pipe are numerous. At a few locations consideration has been given to quadruple pipes of 4, 5 and 6-ft. diameter, but to date none of these culverts has been constructed.

Reinforced concrete pipe is now considered more economical than box culverts for many jobs because North Carolina producers of concrete pipe have improved their facilities to permit economical production of the larger diameters. Maintenance costs for both concrete and corrugated metal pipe culverts are expected to be low. In addition, if a road is relocated or abandoned, both types of pipe can be salvaged, which is not true of box culverts.

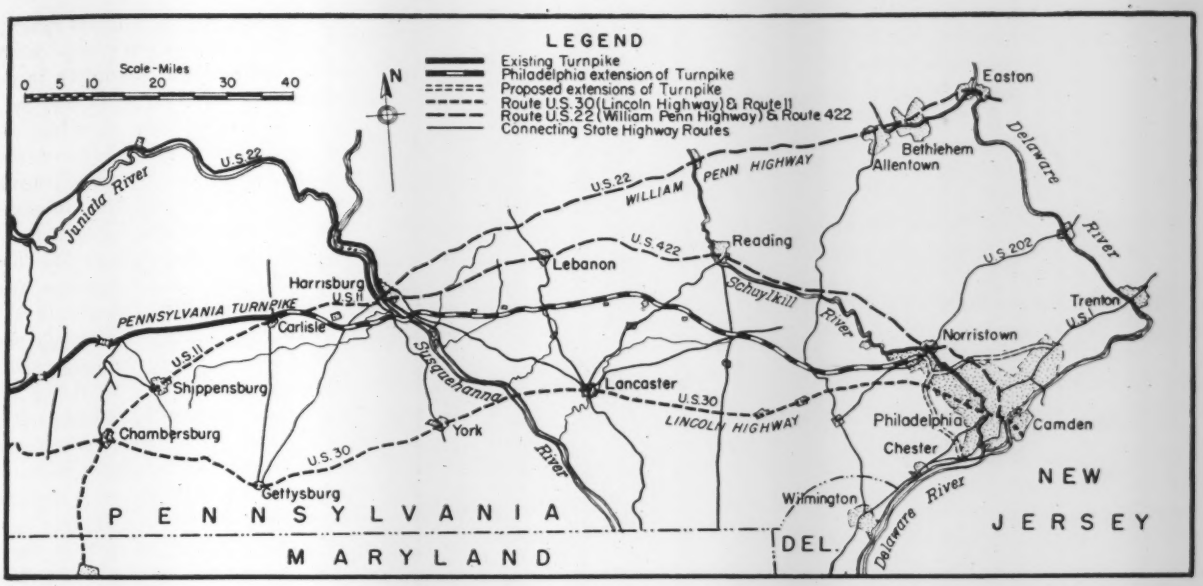
Comparable costs of corrugated metal and precast culverts is shown by the accompanying table. These data are based on the unit prices for all of the culverts awarded by the North Carolina department in 1946 and through November 1947, for several thousand feet of pipe for most of the sizes listed. At present, about as much metal pipe as concrete pipe is being used, although the concrete is preferred for most locations because it is considered more permanent. However, the depth of fill over the concrete pipes is generally limited to about 35 ft., and where the pipe is laid on a steep slope, corrugated metal is used because it can better withstand the pull at the joints due to the grade.

Most bridges I-beam spans

Where a drainage structure larger than a pipe culvert or big box culvert is needed, the general type of bridge built is one calling for simple I-beam spans with a concrete or creosoted timber deck. Cost of creosoted lumber is now so high in North Carolina that the concrete deck is often more economical than timber and is preferred because of its lower maintenance costs and longer life. The foundation generally consists of creosoted timber pile bents with concrete caps, but where less than 10 ft. of natural soil covers the foundation rock, light concrete post-and-beam piers are used. The simple span bridge has proven especially economical for spans of 25 to 40 ft. and in some instances most suitable for spans up to 57 ft. 6 in.

Most of the bridges are built 2 ft. wider at each side than the approach pavements, and in general are designed for an H-10 loading, although on a number of projects an H-15 loading is used.

W. Vance Baise is chief engineer for the North Carolina department; T. V. Fahnestock, bituminous engineer; T. B. Gunter, Jr., bridge engineer; W. E. Hawkins, construction engineer, and L. D. Hicks, head of the soils laboratory.



TOPOGRAPHIC MAPS for extension of the Pennsylvania Turnpike 140 miles to Philadelphia were made in 145 days.

Aerial Surveys Speed Turnpike Location

Frank J. Williams
Gannett Fleming Corddry & Carpenter, Inc.
Harrisburg, Pa.

PLANNING for an eastern extension of the Pennsylvania Turnpike from its present terminus west of Harrisburg to Philadelphia has advanced from preliminary studies to the design stage in a little over a year. In June, 1947, when the Pennsylvania Turnpike Commission asked Gannett Fleming Corddry & Carpenter, Inc. to make the necessary location studies for this 140 miles of superhighway through rugged country and closely built up suburban areas, it wanted the surveys completed in time to permit detailed design studies to begin in the spring of 1948.

It was of course immediately apparent that, unlike the existing 160-mile turnpike, this projected extension of almost equal length would be surveyed and designed in a period of engineering manpower shortage. To find the qualified field personnel necessary to make a ground topographic survey of such magnitude seemed almost impossible and would at best consume much valuable time. Similarly the office personnel necessary to translate that survey to paper was in short supply.

With the two chief elements of the conventional method of highway location surveys difficult to obtain, the alternative was to find another method. Accordingly, with the approval of the turnpike commission, it was decided to select the aerial survey as the method producing suitable topographic maps in the shortest length of time. It is believed that this decision instituted the largest application of aerial mapping to highway location work attempted to date.

Since the best results are obtained from aerial photography when foliage is off the trees, the staff concentrated on general route studies during the summer months of 1947. These studies were made from maps prepared by the U. S. Geological Survey, the Army Map Service, Pennsylvania Department of Highways, and other agencies, and formed the basis upon which the flight strip was selected.

Copies of tactical sheets of the Army Map Service were included in the contract documents. On these sheets the area to be mapped was shown in rectangular blocks that were coincident with the outline of the finished topographic map and numbered to match. The general route, although not totally restricted by the client, was indicated to a certain extent by the desire to avoid highly productive farm lands and congested populated areas.

One square mile per day

Proposals based upon specifications prepared by the writer's firm were invited from the larger photogrammetric engineering organizations and were opened Oct. 14, 1947. Three bids were received, with Aero Service Corporation of Philadelphia submitting the successful one. The contract between Gannett Fleming Corddry & Carpenter, Inc., and this company was awarded on Oct. 15, 1947, and flying started immediately. It was specified that deliveries of completed topographic maps should be made

during the course of the work, with final delivery required within 145 calendar days. This completion date indicated a rate of about one square mile of finished topography per day.

The end product specified consisted of an inked linen topographic drawing, complete in cultural detail, on a scale of 1 in.=200 ft. and showing contours at 5-ft. intervals. The scale width of each finished sheet was one mile and the length covered a distance of 2.5 to 3.1 miles.

Other details of the specifications provided for identification of dwellings by symbol, spot elevation at road and railroad intersections, summits, depressions and saddles, and a coordinate system to be shown at 1,000-ft. intervals. Buildings with any side equal to 60 ft. or more had to be shown in correct outline but others were indicated by a 25 x 25 ft. square. The symbols for streams, swamps, quarries, etc. conformed closely to standard practice.

The entire project required 51 map sheets all of uniform width but varying in length from 5 to 7 ft.

Results found accurate

Field checks were made on each map by our own field parties to determine its conformity with the specifications—which provided that 90 percent of all elevations be correct within one-half contour interval, or 2½ ft., and that the remaining 10 percent were not to be in error by more than one contour interval. A profile 3,000 to 5,000 ft. in length, run in the field, was compared to a profile plotted from the contour map covering an identical line. The accuracy of horizontal dimensions was determined by spot check in the field by actually measuring the distance between certain well defined cultural features.

With the exception of an occasional minor omission, a not unusual result of high speed in the drafting room, the maps were found to conform to the specifications. The important features—vertical and horizontal accuracy—were well within the requirements.

In addition to the topographic map sheets the contract provided for delivery of collateral photographic information to increase the usefulness of the maps. These included photo mosaics at a scale of 1 in.=400 ft., corresponding to the topographic maps in boundaries, a set of contact prints from the mapping negatives at 1 in.=1,000 ft., a set of enlargements at a scale of 1 in.=400 ft., an assembled photo index for all photography completed and a tabulation describing the elevations and coordinates of the aerial mappers control points.

FIELD SURVEYORS, using a precision theodolite and a radio transceiver, established the necessary horizontal and vertical controls for aerial work.

Economical mapping

To those engineers struggling with rising cost problems coupled with reduced productivity of sub-professional help, the aerial survey presents at least a moderate form of relief. It is not intended to imply that the application of photogrammetry to all survey and mapping problems will result in the ending of all such problems. Neither is it implied that the method, as at present developed, will enable the engineer to put his transit and tape in storage. The leading firms in the field of photogrammetry are most emphatic in pointing out its limits of usefulness and maxima of application.

However, for the particular problem discussed here it is felt that in comparison with conventional ground topographic surveys the topographic map resulting from an aerial survey is as accurate, is considerably more complete, is produced faster, risks less human error, and is by far more economical.

On this last point, consider making by stadia survey, or any other ground method, a complete topographic map over an area one mile wide by 141 miles long, showing 5-ft. contours and all cultural features and covering a range of topographic types from rugged, wooded hill country to the solidly built up suburbs of metropolitan Philadelphia, for less than $1.00 per acre. Consider further that this operation required 145 calendar days during the wrong end of the calendar for ground surveying in Pennsylvania, Nov. 1 to March 25.

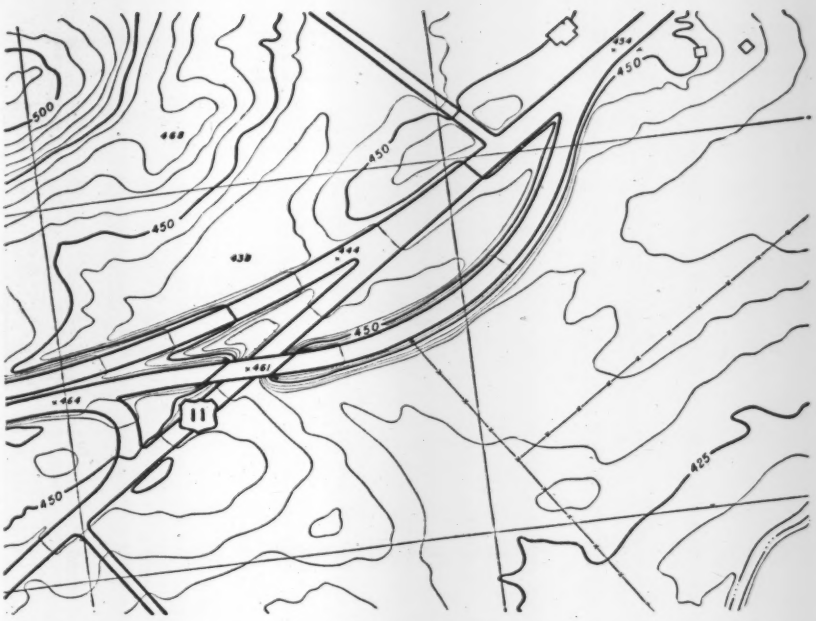
It is an extremely conservative estimate that, if the necessary qualified personnel had been available, to produce an end product of comparable completeness and accuracy would have required a time period five times longer and an expenditure five times larger.

Photogrammetric procedures

The Aero Service Corporation used a single-engine light plane of good range and stability, assigning a veteran pilot-photographer team to the job. Flying at an altitude of more than a mile above the selected route, the aerial camera photographed the area on glass-plate negatives. (Glass plates were used rather than film because of the greater dimensional stability of the glass plates in processing and handling.) The photographer exposed a plate at intervals of about 20 seconds, and the negatives were flown daily to the aerial surveyor's main laboratories at Philadelphia for processing.

After prints were made, a set was turned over to the field surveyors, who established the necessary horizontal and vertical control data. These crews are trained in the use of new precision theodolites, combining traverse and bench leveling. The method eliminated the far slower chaining and spirit-level methods, at no sacrifice in accuracy. Horizontal closures ranged from 1 foot/10,000 to 1 foot/80,000 with 1 foot/30,000 the average. The average error of vertical closure of level measurement was .004 ft. per mile.

In general, a time saving of 20 to 50 percent over older methods for this work is effected with this technique. Radio communication was used to speed the necessary ground survey work. On traverse work, with



TOPOGRAPHIC MAP of the present eastern terminus of the Pennsylvania Turnpike. This is a direct reproduction of a section of one of the topographic maps for the whole route by aerial methods.

an average distance of a mile between working parties, it was found that visual signals often were not clear. The survey crews then were equipped with compact radio transceivers—short-wave radio receiving and broadcasting units powered by self-contained battery units, which have a line-of-sight range of a few miles. Field parties using these units could quickly coordinate their basic control. All of the control was tied into control points of the Coast and Geodetic Survey for both the horizontal and vertical positions.

With the field survey data at hand, the compilation of the topographic map from the aerial photos was accomplished with photogrammetric equipment. The technical aspects of this process are quite interesting. The aerial photographs are exposed so that full steroscopic coverage for the area is obtained. Basically, the method employs the same principle as the old parlor stereopticon, but the modern aerial photos are made with precision cameras and lenses, then processed through precision measuring and contouring equipment so that true elevations may be obtained.

Each photographic plate has a forward overlap of 55 percent, as well as a considerable overlap at the sides. These stereo photos are taken about one-half mile apart, at an altitude of more than a mile, giving a gigantic separation and increased stereoscopic depth to the view. After field survey parties have established control points for the areas photographed and the plates are rectified for tilt, contouring begins. Using very precise mapping equipment operating on a principle similar to the military range finder, the stereometer operator measures exactly the ground elevations from these stereo views. He is able to draw contours on the photograph to within one-half contour interval two and one-half feet in this instance.

In addition to the topographic features, all the wealth of planimetric detail appearing on the aerial photos is added to the topo maps. Roads to their proper width, buildings, streams, wooded areas, transmission lines and other important data are revealed to the stereometer operator for recording on the map sheets.

A point not to be overlooked in a project of this type and size involves the problem of gathering the necessary information without divulging the proposed location, at an early stage, to land speculators. This particular route was flown and photographed in about two working days without powdering the landscape with surveyors. It should be noted here that the strict confidence in which all data were held by the employes of both the aerial surveyors and the consulting engineers almost approached the phenomenal. Until the Governor of Pennsylvania formally announced the location, the local press had failed to name any major point within seven miles of the actual line.

Design details not fixed

Although final design has not appreciably advanced at this stage, certain departures from the design of the existing Pennsylvania Turnpike are under consideration. Notably among these will be a maximum grade of two percent and a maximum curvature of three degrees. Tangents between reversed curves will be held to a minimum of 1,000 ft. and between curves in the same direction will be held to a minimum of 2,500 ft. The country in general is not as rugged as the present line across the Allegheny Mountains and will require no tunnels, but a major structure of about 4,000 ft. in length will be required to cross the Susquehanna River near Harrisburg.

Transitional spirals and superelevation will be applied to curves for a design speed of 70 miles per hour.

The extension traverses a more highly developed country and consequently will intersect more roads and railroads. As all rail lines and highways are separated, the frequency of structures increases from 1.8 per mile on the original turnpike to about 2.4 per mile on the extension. This factor alone will act as a deterrent to the desire to increase the width of the divisor strip, which is 10 ft. on the completed portion. To increase the span or width of over 200 bridges would add no mean amount to the total construction cost.

The location of interchanges must await the completion of the traffic analysis now underway, but it can be estimated that about nine will be required. As all turnpike traffic must be channeled to a toll booth for exit and entrance, no change in fundamental features is contemplated. However, where space and economics permit, the minimum radius on the various ramps will be increased to ease the flow of leaving and entering traffic.

Within the past few weeks a group of four large banking houses offered to underwrite $70,000,000 in bonds of the Pennsylvania Turnpike Commission for this extension.

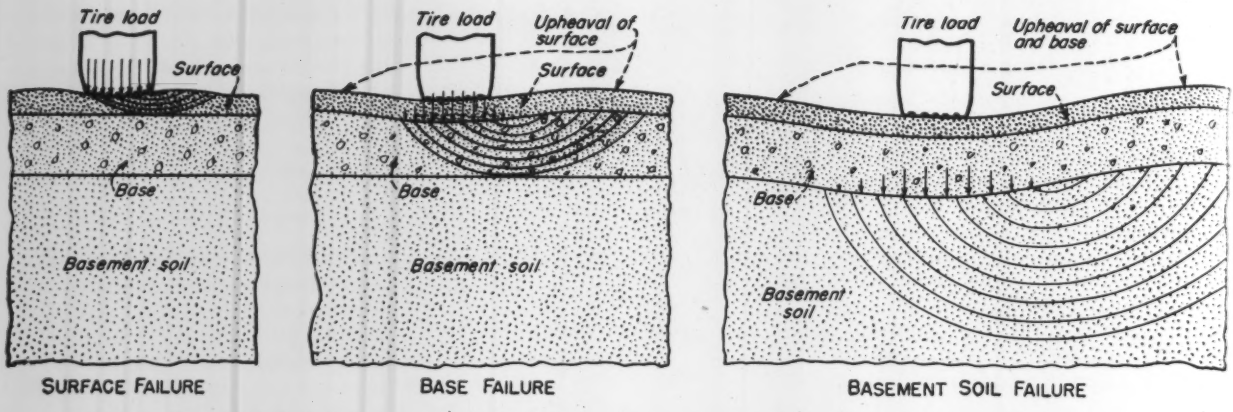


***FIG. 1. TYPES OF FAILURE** in pavements and bases studied in developing the design chart shown in Fig. 2.*

A New Approach for Pavement Design

F. N. Hveem
Staff Materials and Research Engineer,
California Division of Highways, Sacramento, Calif.

A NEW METHOD for evaluating soils and calculating the thickness of pavement and pavement base required over any type of soil to support highway traffic or airplane wheel loads carried on pneumatic tires is under study by the California Division of Highways. A relatively simple design chart has been developed (Fig. 2) that makes use of certain physical characteristics of the basement soil and the pavement or pavement base as well as the surface loading. The theory on which the chart is based has been substantiated by results obtained on highway and airport test tracks.

This design procedure rests on the premise that pavements and bases are effective in supporting loads chiefly because of the "surcharge effect" and, therefore, that the strength and weight of the surface and base layers must be designed to resist the potential upward thrust of the subgrade at points adjacent to, but outside, the area actually under load. This means that a load transferred through a layer of bituminous surface or crusher-run base may or may not be "spread" over the underlying layer or subgrade, but that the most important aspect is the tendency for particles in any layer to be displaced along a curved path (Fig. 1), and thus develop an upward thrust against the underside of the base or surface layer. This concept has been expressed by Roland Vokac (*Proceedings*, Highway Research Board, 1943) and by Glossop and Golder in England.

Use of the design chart

The detailed procedure in applying the design chart is given in a box accompanying Fig. 2. However, the three factors used warrant fuller explanation. The first factor indicates the ability of the basement soil (or any imported layer) to resist displacement, and is designated as the "resistance value" R. This unit is a measure of the stability of the soil layer. It may be obtained directly from stabilometer tests by the expression

$$R = (1 - P_h/P_v)\ 100 \qquad (1)$$

In this equation, P_h is the horizontal pressure and P_v the vertical pressure.

The second factor used in this chart is the traffic index. This is a measure of the destructive values to which the pavement is subjected by traffic, and takes into account both the magnitude of the wheel loads and the number of times the loads are applied during the design life of the pavement (wheel load repetition).

The final factor recognized, the cohesion value c, indicates the tensile strength of the layers (pavement and/or base) that may be placed over the basement soil. This value is measured by a cohesiometer and for rigid materials has a linear relationship to the modulus of rupture.

When a stabilometer is not available, less elaborate testing or evaluation procedure can be substituted with some results being less accurate. Work done by D. J. Steele of the Public Roads Administration (*Proceedings*, Highway Research Board, 1945), provides a group index scale for classifying soils which shows a

NOTATIONS

The symbols used in this article are defined as follows:

a = pavement area covered by pneumatic tire, sq. in.

c = cohesiometer value of pavement or base (for rigid materials this value corresponds to modulus of rupture times 45.3).

CBR = California bearing ratio.

D = deforming effect of pneumatic tired wheel loads.

EWL = equivalent 5,000-lb. wheel loads.

K = a constant that may vary from 0.0175 to 0.02 or more, depending on the factor of safety desired. Fig. 2 is drawn with $K = 0.02$.

P = pressure developed in the pavement by tire load, psi.

P_h = horizontal pressure, i.e., stabilometer reading, psi.

P_v = vertical pressure applied in the stabilometer test, psi.

r = number of wheel or axle load repetitions.

R = resistance value of the soil (range 0 to 100).

S = tensile strength of pavement or base.

T = thickness of all layers, including pavement, base, subbase, etc., above soil in question, inches.

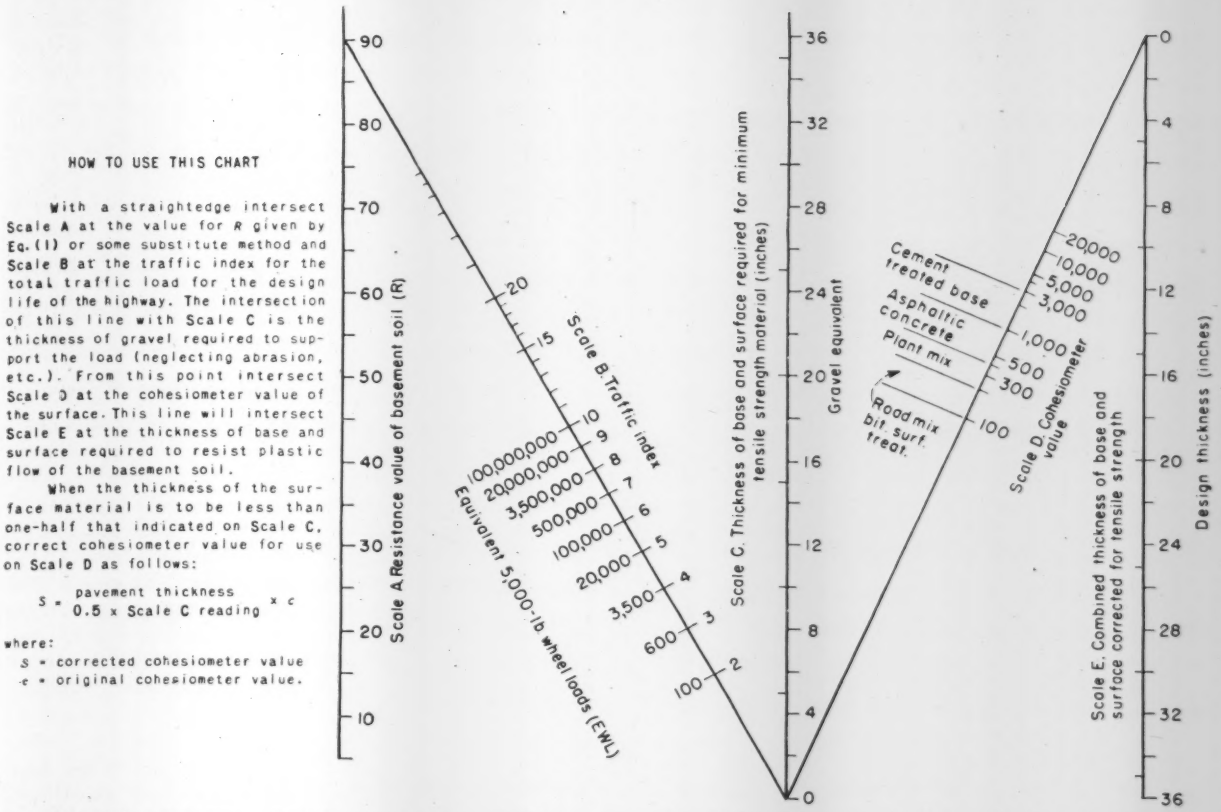

HOW TO USE THIS CHART
With a straightedge intersect Scale A at the value for R given by Eq. (1) or some substitute method and Scale B at the traffic index for the total traffic load for the design life of the highway. The intersection of this line with Scale C is the thickness of gravel required to support the load (neglecting abrasion, etc.). From this point intersect Scale D at the cohesiometer value of the surface. This line will intersect Scale E at the thickness of base and surface required to resist plastic flow of the basement soil.
When the thickness of the surface material is to be less than one-half that indicated on Scale C, correct cohesiometer value for use on Scale D as follows:
S = pavement thickness / 0.5 x Scale C reading x c
where:
S = corrected cohesiometer value
c = original cohesiometer value.
Scale A. Resistance value of basement soil (R)
Scale B. Traffic index
Equivalent 5,000-lb wheel loads (EWL)
100,000,000
20,000,000
3,500,000
500,000
100,000
20,000
3,500
600
100
Scale C. Thickness of base and surface required for minimum tensile strength material (inches)
Gravel equivalent
Cement treated base
Asphaltic concrete plant mix
Road mix bit. surf. treat.
Scale D. Cohesiometer value
20,000
10,000
5,000
3,000
1,000
500
300
100
Scale E. Combined thickness of base and surface corrected for tensile strength
Design thickness (inches)

***FIG. 2. DESIGN CHART** used in the new design method to compute the thickness of compacted gravel with a light surface treatment or the equivalent thickness of base and pavement.*

fair correspondence with the R value as derived from the stabilometer (Fig. 4).

In addition, in an unpublished communication, Mr. Steele has also suggested a relationship with the California bearing ratio (CBR) that when combined with the grading analysis and measured expansion, may also be used to give approximate values of R (Fig. 3). Either method for deriving R may be used in Fig. 2 for estimating the required thickness. It must be emphasized, however, that these alternate methods are not completely dependable or reliable for all materials.

Three factors related by formula

The over-all analysis of the problem indicates that there are three primary factors to be considered in designing the thickness of pavement capable of supporting traffic loads over the more or less plasticized mixtures of rock particles commonly called soil. First is the unit resistance R of the soil material over which the pavement or surfacing is to be constructed. This expresses the ability to resist plastic deformation. Second is the accumulative destructive or deforming effect D of all the wheel loads that will pass over a given path on the pavement. This is the ability to produce plastic deformation. Third is the slab strength or tensile strength S of the pavement and base. This strength, in combination with the thickness of all layers above the soil in question, prevents the underlying soil from moving under the traffic.

These factors can be shown to have the following general relationship:

$$T = \frac{KD\,(90\text{-}R)}{S}$$

The resistance value as employed in this equation is primarily due to friction between the soil particles. The cohesive value or tensile strength in the soil layer is neglected because it cannot be relied upon any more than can the tensile strength of concrete in a reinforced beam. Material having a value of R greater than 90 would be capable of sustaining traffic without pavement cover except that it probably would lack the cohesive value or tensile strength needed to resist the abrasive action and thrust of the tires.

Fig. 2 is a graphical representation of the relationship between these values. In discussing the details of this formula and the corresponding chart, it is necessary to describe the basis for evaluating the three principal variables.

Soil resistance discussed

First is the question of soil resistance R. It has long been customary to speak of the supporting power or "bearing value" of soils and test procedures have been devised which are characterized as tests for "bearing value." It is well known by most engineers familiar with the behavior of soils and granular materials that the actual capacity to support loads varies considerably with the conditions of loading. Furthermore, the response of granular materials to different load areas varies widely, depending upon properties of the soil. Therefore, one of the tenets in the following discussion is to the effect

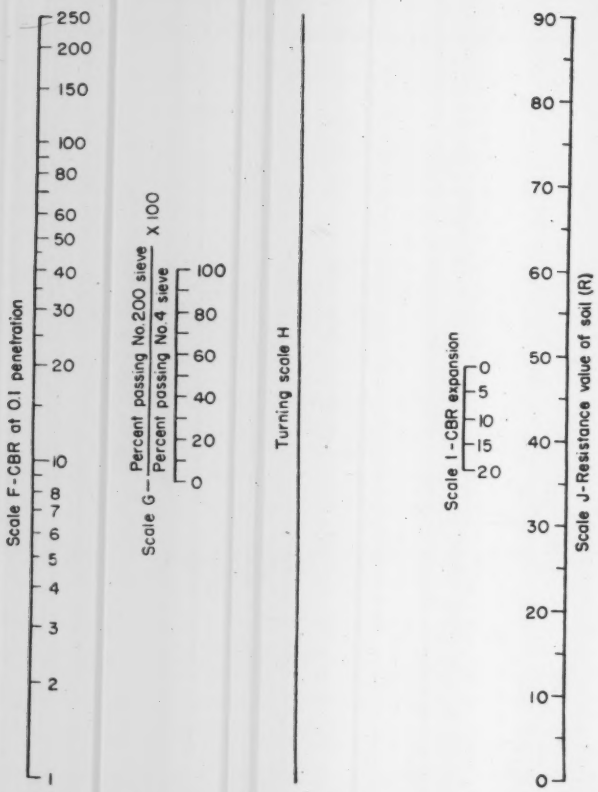


FIG. 3. WHERE TEST DATA or Stabilometer equipment are not available, a fairly reliable estimate of the resistance value may be obtained from California-bearing-ratio test results. This chart shows the relationship involved. However, it is not applicable for any material possessing all three of the following characteristics: (1) Less than 75 percent passing #4 sieve, (2) more than 8 percent passing #200 sieve, and (3) a product of the plasticity index and percent passing #200 sieve greater than 72.

that the term "bearing value" is not correctly applied to most soil strength test data and that the engineering properties of soils and granular materials can be more correctly evaluated in terms of internal resistance to deformation.

The usual approach attempts to analyze the load carrying capacity of granular materials through mathematical treatment based on the theory of elasticity. However the properties of such materials may be more easily understood by extending the principles of hydrostatics or by comparing the mechanics of soils to the behavior of liquids under pressure. It is, of course, axiomatic that one characteristic of a liquid is the ability to transmit pressure equally in all directions Masses of fine and coarse granular particles, particularly when combined with varying amounts of water, form combinations that will transmit some pressure in all directions, but not in a uniform pattern or to equal degree.

Therefore, if a sample of soil or granular material is placed in a cylinder and loaded under a tight-fitting piston, pressure will be transmitted to the sidewalls of the cylinder but the pressure thus transmitted can vary considerably. This variation depends upon the character of the soil particles and the amount of liquid combined with any clay or colloidal material. The whole relationship may be summarized by stating that the lateral pressure will vary inversely with the internal resistance of the mass. If a specimen of soil is prepared in the form of a cylinder and subjected to vertical loading with means for measuring the lateral pressure developed in the process, then the relative ability of a soil to transmit pressure may be indicated by the formula

$$\text{Lateral Thrust Ratio} = \frac{P_h}{P_v} \qquad (3)$$

The stabilometer furnishes a means for directly measuring the ratio between the vertical pressure applied to a test specimen and the lateral pressure transmitted by the materia under load. For a stable roadwa structure, the lateral support required and also the resistance furnished b the base and surface, must be varie in direct proportion to the latera pressure, as indicated by Eq. 3. I naturally follows that the capacity o a given layer of the soil to resist su perimposed loads will be in inverse proportion to the above expression Therefore, the resistance value of th material tested is indicated by Eq. 1

Wheel load repetitions a factor

Next, it is necessary to establish a comparable means for evaluating the service loads or the potential tendency of pneumatic tired vehicle wheels to cause distortion or deformation. An examination of data developed on test tracks built by the California Division of Highways and on a track constructed by the Corps of Engineers at Stockton, Calif., indicates that, other things being equal, the minimum thickness or strength of the base and surfacing required to sustain traffic must increase directly as the logarithm of the axle load repetitions. This relationship has also been suggested by Norman McLeod of Canada.

From an examination of the markings on the pavement and the destruction produced it appears that the effect of moving vehicle wheels is comparable to a load applied on a strip the width of the tire and of a length varying with the speed of the vehicle. In addition, the width of a pneumatic tire print varies with the size of the tire, with the tire pressure, and with the load. Therefore, the potential deforming effect of loads carried on pneumatic tired wheels may be summarized by the expression

$$D = P\sqrt{a}\log r \qquad (4)$$

This equation agrees wth other formulas previously proposed, that indicate the thickness of cover varies according to the square root of the load.

To use this expression, all of the various axle loads must be counted or estimated and calculations made to determine the accumulated composite effect. An empirical approximation is secured by a simple method now in use by California Division of Highways. An estimate is made of

the number of vehicles equipped with the various axle combinations. To this is applied an aribtrary set of constants that have been assigned to represent the relative destructive effect of the various wheel load groups. These constants are given in Table I.

The number of axle loads in each group is estimated as accurately as possible, preferably from traffic census and loadometer data, and the number of loads per year in each group is multiplied by the assigned factor. The products are added and multiplied by the number of years contemplated as a basis for the design life of the pavement.

For example, traffic census on a given highway indicates a total of 22,737,456 vehicles in ten years. Of this number, the heavy traffic may be classified into wheel load groups, use percentages applied, and the equivalent 5,000-lb wheel loads computed as shown in Table II.

Results of computations similar to Table II obviously will not correspond to computed values derived from the formula proposed to express the destructive effect of traffic (Eq. 4). However, all attempts to estimate traffic for the future on any highway must be subject to so many imponderables that one is not inclined to engage in hair splitting as long as the relative values used are reasonably correct. Accordingly, Eq. 4 was modified and Fig. 2 developed on the basis of the following:

$$T = \frac{0.12 \log \text{EWL} \ (90\text{-}R)}{\sqrt[4]{c}} \qquad (5)$$

(In this equation, $\sqrt[4]{c}$ has been substituted for S as this term has been established empirically to express the tensile strength of the pavement and/or the base.)

Equivalent "gravel" thickness

Neglecting the pavement-strength factor for the moment, it is now possible to compute the thickness of gravel or granular material that, by its weight alone, will counteract any tendency of the underlying basement soil to be displaced and thrust upward as a result of vehicle loads.

In pursuing this theory of design, it becomes evident that the internal stability or resistance value of any granular sub-base or base course will have little influence on the thickness required so far as protecting the underlying soil is concerned. (Provided, of course, that the base material has sufficient sand or fines to prevent infiltration of a clay soil). In other words, there will be little or no difference between the thickness of clean sand, gravel, crushed stone or any combination of materials that resists displacement of the subgrade simply by means of the weight of the superimposed layers. This latter conclusion may be somewhat surprising to some, but the evidence appears to be ample and, when viewed in the light of the theoretical premises, there is no reason for any difference. This viewpoint has already been expressed by Spangler and Vokac and recently supported by McLeod.

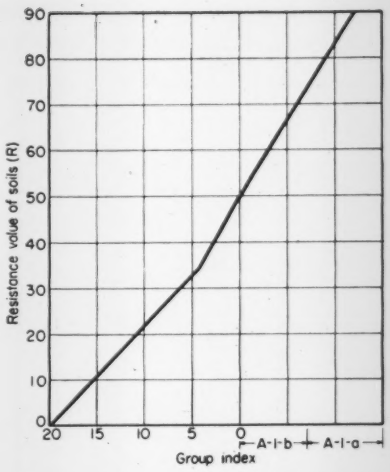


FIG. 4. ANOTHER APPROXIMATION for the resistance value is available through use of a group index classification developed by D. J. Steele of the Public Roads Administration.

On the other hand, it has long been known that a lesser thickness of pavement is required provided the pavement has some definite flexural strength or slab strength. For example, a plank has substantial supporting power when placed on soft mud or swampy ground, while a layer of bricks would soon sink out of sight.

In order to estimate the reduction in total thickness made possible through the use of a strong pavement or base, it is necessary to make an allowance for the one distinctive property these materials possess; namely, tensile strength or cohesive strength. It is evident from the examination of test track data that, other things being equal, the ability to support traffic increases as some function of the tensile strength. The slab strength of rigid materials, such as portland-cement concrete or cement-stabilized base mixtures, can be indicated by flexural strength tests and the modulus of rupture.

Although the modulus of rupture concept is not readily applicable to such yielding or ductile materials as bituminous pavements; such materials do possess measurable tensile strength, especially under rapidly applied loads. This strength can be evaluated by means of the cohesiometer, an apparatus capable of breaking small beams of bituminous mixtures in tension. By using a controlled rate of load application, the tensile strength or modulus-of-rupture values for compacted bituminous mixtures and rigidly cemented mixtures may be compared in the same scale.

This arrangement is purely arbitrary and holds good only as long as a certain normal range of traffic speed

TABLE I — CONSTANTS USED TO REPRESENT DESTRUCTIVE EFFECT OF TRAFFIC.

Wheel Load (lb.)	Factor
4,500 to 5,500	1
5,500 to 6,500	2
6,500 to 7,500	4
7,500 to 8,500	8
8,500 to 9,500	16
9,500 and over	32

TABLE II—METHOD OF COMPUTING EQUIVALENT WHEELS LOADS (EWL).

(1) Wheel Load Groups	(2) Percent of total Vehicles	(3) Number of Vehicles	(4) Factor	(5) EWL (3) x (4)
4,500–5,500	10.71	2,435,000	1	3,435,000
5,500–6,500	9.61	2,185,000	2	4,370,000
6,500–7,500	11.96	2,719,000	4	10,878,000
7,500–8,500	6.02	1,369,000	8	10,950,000
8,500–9,500	3.40	773,000	16	12,369,000
9,500 and over	0.91	207,000	32	6,621,000
Total equivalent wheel load in 10 years				47,623,000
Design repetitions (traffic in one direction)				23,812,000

Tables I and II are from *California Highways and Public Works*, March, 1942.

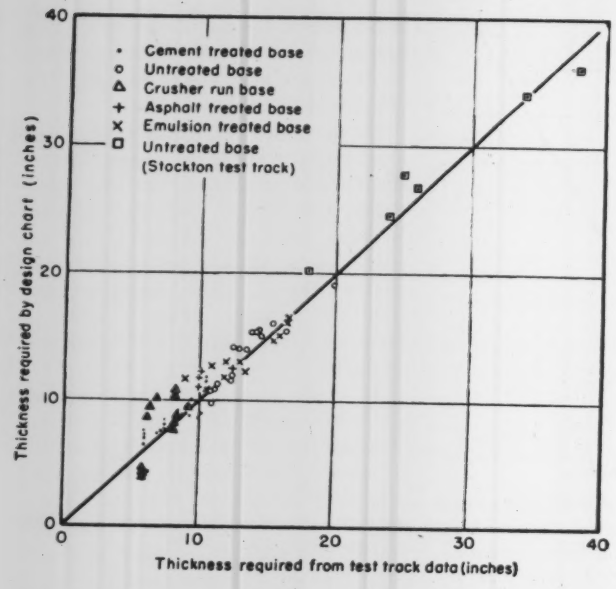


FIG. 5. PAVEMENT DESIGN calculated from Fig. 2 and thicknesses developed in the course of test track experiments show a correlation.

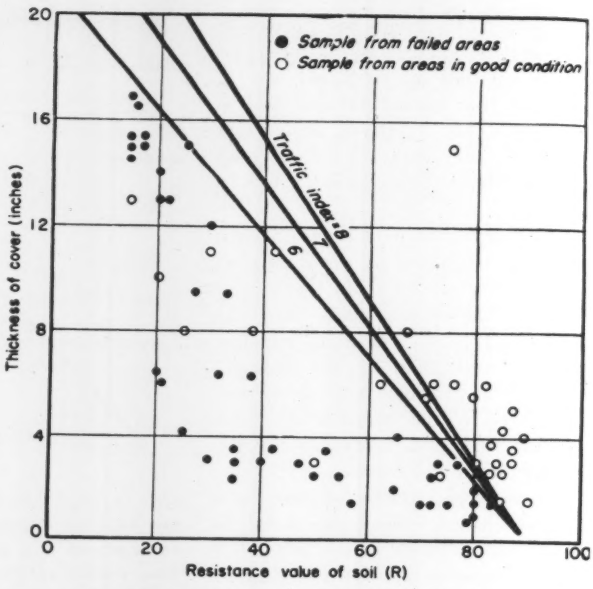


FIG. 6. A RELATION between some of the factors used in Fig. 2 and scattered samples from existing highways is shown by this chart.

is considered. For extremely slow speeds or for standing loads, the values assigned for the tensile strength of bituminous pavements should be reduced, while on the other hand, the values could be substantially increased for very high speed traffic or for colder climates.

In any event, with increasing slab strength the total thickness of base and surface may be reduced below the amount required for uncemented granular materials alone and the magnitude of this correction is indicated by Scale D on Fig. 2. The entire relationship is indicated by the formula

$$T = \frac{K\,(P_b/P_v - 0.10)\,(P\sqrt{a}\log r)}{\sqrt[4]{c}} \qquad (6)$$

It is well known that soils are fairly complex mixtures of organic and inorganic materials with varying amounts of water always included. Such complexity is illustrated by a report listing the essential details of 22 proposed methods all different, for calculating the thickness of base and surface required over various types of soil (*Proceedings*, Highway Research Board, 1945).

A current AASHO committee, engaged in the preparation of a construction manual, have stated that "as yet no mathematical formula has been developed on a theoretical basis which can be depended upon to give the thickness of layer which is required to serve satisfactorily." The same statement could also apply to empirical methods. Thus, the procedure proposed herewith is one more in a long list of attempts to provide a solution to a vexing problem.

Not a panacea for pavement ills

While it is believed that Fig. 2 includes all essential factors influencing the thickness and strength requirements for pavements and base materials, it is not claimed to cure all weaknesses and shortcomings which may develop in pavements or roadway surfaces. Pavements can fail not only because of inadequate thickness or strength or because of a poor subgrade, but also from causes inherent in the composition of the pavement materials.

For example, bituminous pavements may be unstable or may disintegrate due to the action of water or because of improper mixture design. Concrete pavements have disintegrated due to freezing and thawing or to the action of salts attacking the pavement. Also, they may deteriorate through destructive reaction between alkali in the cement and certain types of aggregates. Further, portland-cement concrete pavement joint troubles are not cured by increasing the slab thickness.

Increasing the depth of the base or sub-base will not correct troubles arising from the fact that the base material itself is unstable. Therefore, it should be clearly understood that the foregoing outline deals only with those problems of paving design that can be solved by providing a pavement and base of adequate thickness or slab strength.

It must be further pointed out that pavements may fail or at least may develop extensive cracking over soils that have excessive resilience or ability to rebound after loading. There are many examples to be observed where badly cracked pavements have not distorted appreciably. Certain resilient or "springy" soils will support traffic loads without permanent displacement. In such cases, it is evident that the foundation is sufficiently deflected under the passing of each load to cause extensive cracking of any rigid pavement whether concrete or of some bituminous type.

Use of stabilometer

The foregoing discussion rests upon the belief that the resistance of a soil to plastic deformation may be determined most simply and directly by means of the stabilometer. It should, however, be emphasized that this test is not applied according to prevailing notions surrounding the determination of angle of friction and cohesion by the triaxial shear method.

The triaxial shear test as commonly performed requires a specimen in which the height is at least two and one-half times the diameter and, in the process of testing, loads are applied until "failure" is indicated against some arbitrary preestablished lateral pressure. In the stabilometer test no attempt is made to establish any so-called failure point as it seems that the term "failure" is a rather vague and elusive concept when applied to the distortion of either plastic clays or cohesionless sands.

The stabilometer is used to determine the ratio between vertical pressure P_v and horizontal pressure P_h. When expressed as the ratio $(1-P_h/P_v)\times 100$, it furnishes values in a linear scale reflecting that portion of the soil resistance resulting primarily from friction between the particles under the conditions of lubrication existing in the test specimen.

Reproducing road conditions

It is important that the material be tested in the most unfavorable condition that may be expected to develop in the road-bed during the life of the project. Applying this principle means that the sample should be compacted, degraded, and combined with an amount of moisture to correspond to the worst conditions expected in service. This principle includes the possibility that under certain conditions, the use of relatively dry samples might be justified. However, in the absence of definite knowledge to the contrary, all soil materials should be tested at saturation and should represent both the kind of compaction and the degree of density that can be obtained and maintained after the material is in place on the road.

Excepting frost action, the ultimate equilibrium condition for a given soil depends upon the swelling characteristics of the soil and the weight of the layers of base and surface material with which it is to be covered. The moisture content of the soil when tested should correspond to its moisture content after readjustment and expansion in the roadbed. To predict the future capacity for moisture, it is necessary to measure the capacity of the soil while under load to expand or swell due to water actions. An apparatus has been devised for measuring the expansion pressure. The expansive force is measured on several trial specimens compacted to different degrees and saturated. The resistance value is then measured by the stabilometer. By means of intersecting curves, these two values are reconciled to indicate the most economical thickness of cover material that will satisfy both considerations.

Other methods of estimating R

Where stabilometer and an adequate compaction device are not available, some less elaborate testing or evaluation procedure is desirable. A considerable amount of work has been carried out by various agencies throughout the years on an entirely different approach to the problem, namely, seeking to evaluate the soils by means of soil classification schemes. Such classifications have been developed by the Public Roads Administration, Civil Aeronautics Agency, and the Corps of Engineers. Most of these classification schemes are not directly or reliably translatable into the supporting power of the soil.

D. J. Steele of the Public Roads Administration has outlined a method for establishing a soils group classification for design purposes (*Proceedings*, Highway Research Board, 1945). Steele's group classification is based upon the Atterburg limits and the grading analysis. It appears that a fairly good correlation exists between this classification and the soil resistance values measured in the stabilometer. Fig. 4 indicates the approximate relation between the group index and the R value.

By use of another procedure suggested by Mr. Steele, R values may be derived from CBR test data. This involves (a) certain limitations on the type of material tested, (b) correction for the amount of expansion developed during the soaking period and (c) correction for the amount of material passing a No. 200 sieve. Fig. 3 indicates the manner in which test results from the CBR apparatus may be converted into the equivalent resistance values. This chart should not be used for any material possessing all three of the following characteristics: (1) Less than 75 percent passing #4 sieve, (2) more than 8 percent passing #200 sieve, and (3) the product of the plasticity index and percent passing #200 sieve greater than 72. This conversion appears to have fair correlation for most materials other than those specifically excepted.

Fig. 5 indicates the degree of correlation between the thicknesses indicated by Eq. 6 and the actual minimum thickness that gave satisfactory results on the test tracks. Best agreement between the data and the formula is achieved by the value of $K = .0175$. However, in preparing Fig. 2 the value of K was increased to 0.02 to place all calculated thicknesses on the safe side. Fig. 6 indicates the relationship between the values of R and actual performance as indicated by scattered samples taken from existing highways.

Method under study

The procedure outlined in the foregoing, using Fig. 2 and Fig. 3, is now being put into use on a trial basis for flexible pavement design by the California Division of Highways. It is not unlikely that certain modifications or revisions will be indicated as experience is accumulated.

It must be pointed out, however, that the inevitable variations in soils and all naturally occurring granular materials will always tend to offset any extreme refinement or precision in applying a design formula. There are limits to the control which may be exercised during construction. There is a question whether it will be possible to realize any practical benefits from further refinements in the method.

The writer wishes to acknowledge the contributions of the many individuals and organizations who have made it possible to develop the pavement design procedure outlined in the foregoing. The work was done in the Laboratory of the California Division of Highways under G. T. McCoy, state highway engineer, and T. E. Stanton, materials and research engineer. The necessary test data were obtained from two test tracks constructed by the Division of Highways and one by the Corps of Engineers at Stockton, Calif. Much credit is due Robert Carmany, who developed most of the mathematical relationships, and Ernest Zube, who was in charge of the testing and recording of observations on the test track. D. J. Steele and Walter Liddle of the Public Roads Administration gave much valuable assistance and advice.

FIG. 1. A SUBSTITUTE FOR THE OLD "CLOVER-LEAF" INTERSECTION is exemplified by this connection between the Mission Valley Road and the Cabrillo Freeway. Through it, all interchange movements are in the normal direction except the two left-hand turns from the lower road to the one crossing overhead. These turns are sufficiently direct to eliminate any confusion.

Movements Through Interchanges Simplified by Better Designs

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ONE of the most important elements in freeway design is the traffic interchange. Its purpose is to separate traffic streams on the freeway from similar streams on intersecting streets or highways as well as to provide for interchange of traffic with a minimum of delay or danger and a maximum of facility and safety. Yet many of the designs that were evolved in early attempts to facilitate these interchange movements provided cartoonists with an unexpected harvest. Their witty portrayals of the consternation of the motorist confronted with a labyrinthine interchange had some basis in fact, we must ruefully admit.

This humorous disapproval of traffic interchange complexity serves admirably to emphasize the salient and fundamental rule of good interchange design—simplicity.

Paradoxical as it may seem, simplicity is the most difficult goal to achieve. This is due to site restrictions, to the need for taking land use and population trends into consideration along with the types and volume of traffic, present and potential, and to cost.

Limitations due to site

The initial approach to any interchange problem is the determination of the site. While there are instances where some latitude is permitted the designer in selection of the site locale, most frequently the proposed freeway crossing of existing important roads or streets will be the determining factor in site location, and we are faced with the problem of taking the area available and producing an interchange pattern that will provide the maximum utility.

Likewise, existing culture and development, as elements affecting our design, are matters which we must take as we find them. As opposed to this, potential or future land use plans or development can materially change existing unattractive slum areas or undeveloped lands into desirable and highly developed communities. Hence, this factor must be carefully considered, both from the

standpoint of avoiding design types or forms that would detract or depreciate such improvements, as well as to make certain that predictions of future traffic use take cognizance of such a possibility.

Of all the factors which influence the selection of the form and type of an interchange facility, the volumes and patterns of present and potential traffic movement are the most important. This is due to the fact that good design will always insure preferential treatment in alignment and grade for the traffic movements of heaviest volume. Hence, if the predicted traffic movements at any important interchange are sketched on a traffic-flow diagram, the general form the interchange must take to provide for these preferential movements will be indicated thereon.

Basically, an interchange solution to be worthy of being designated as successful should meet the following objectives:

(1) It should fit the site.

(2) It should be designed to accord with the volume, type, and speed of traffic to be accommodated.

(3) It should be as simple as possible, which is to say the major movements should be natural and direct.

(4) It should be the most economical solution that will satisfactorily meet the other objectives.

In applying forms or types of interchange to a particular problem, it is well for the designer to keep in mind there are only two fundamental types of interchange, which have been designated as the "direct" and the "indirect".

FIG. 2. MODEL OF THE INTERCHANGE now under construction to provide for rapid movement between the Hollywood, Santa Ana, Arroyo Seco and Harbor parkways in Los Angeles. Braiding the lanes in four planes vertically has made it possible to eliminate sharp and confusing turns that slow traffic.

FIG. 3. THIS TWO-QUADRANT CONNECTION between the North Sacramento Freeway and Swanton Road illustrates a layout that is adequate where the crossing road is of secondary importance.

Direct and indirect interchanges

The classic example of the indirect interchange is the full "cloverleaf" where all left turns are accomplished by circuitous right-hand movements over inner loops through 270 deg. of angle.

A direct interchange is one in which all interchange movements can be made in the direction that would be taken naturally in making the desired change of direction with a minimum of angular turning. As this is accomplished by separating the lanes of one highway and weaving them through the separated lanes of the other, these interchanges are also known as the fully braided type.

Braiding can be accomplished in the vertical as well as the horizontal plane. A good example is the four-level structure in Los Angeles shown in model form in Fig. 2, which is now under construction.

With respect to these basic types of interchange, there is a growing feeling on the part of design engineers generally that the indirect or clover-leaf type of structure has serious limitations for use where extremely heavy interchange movements are involved.

Not only are all the left-turn movements unnatural, but they involve extremely circuitous paths, and if the inner loops are to provide for reasonable speed of operation, the radius of curvature required is so large as to utilize large areas of right-of-way. Frequently, the cost of the required area will exceed any savings in structure cost, which is the one and only advantage the indirect interchange has. This disadvantage, added to the economic loss of travel time and distance over the circuitous paths should generally eliminate cloverleaf designs

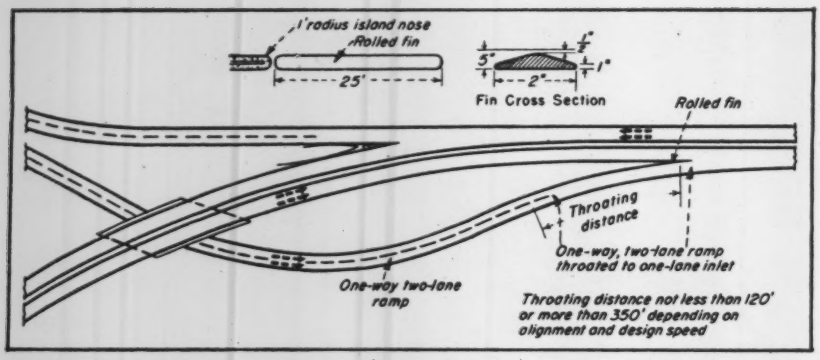

FIG. 4. CHANNELING A TWO-LANE ROADWAY down to one lane where it enters a main highway has been adopted in California as a safety measure.

from consideration where large volumes of traffic are involved, even where no cognizance is taken of other disadvantages inherent in the design.

In this connection, note the ease and directness with which all interchange movements can be made through the interchange shown in Fig. 1 as compared to those required for many movements through a cloverleaf-intersection.

Secondary interchange points

The most logical and satisfactory application of the indirect type of interchange is to situations where the road intersecting the freeway is of secondary importance and hence the volumes of interchanging traffic are relatively minor compared to the volumes on the main roadway. At these locations the two quadrant semi-cloverleaf will frequently be found to provide entirely satisfactory service.

In some cases, it will be found advantageous to provide both inner loops and outer connections in one or more of the quadrants if the predicted movements in these quadrants are of materially greater importance than in the others.

In California, we are finding that hybrid design solutions merit serious consideration in studying some types of major interchange problems. For instance, if the major interchange movements are found to be in only one or two of the quadrants, these can be provided for by direct or braided ramps; and the relatively minor movements in the other quadrants can be satisfactorily accommodated by the cheaper indirect features of semi-cloverleaf design. This will particularly apply to those cases where traffic interchange volumes are low and design standards affecting speed of operation can be correspondingly reduced.

In those cases involving the intersection of major freeways where interchange movements will be heavy in all quadrants, there is no longer any question in our minds with respect to the basic type required. Every argument in such cases is in support of the direct or multiple structure type. Where right-of-way costs are high and the terrain permits, braiding the movements in the vertical plane is indicated. Where land costs are more moderate, braiding in the horizontal plane will serve. Often both vertical and horizontal braiding in combination will better fit conditions.

In any case, every effort should be made to simplify traffic operations by having right-hand take-offs for right turns and left-hand take-offs for left turns. Multiple choice take-offs should be avoided, which is to say that ample perception space should be provided between successive exits and entrances so that the driver has ample opportunity to select the position in the traffic stream most favorable to his intended movement. Two exits close together, or an entrance and an exit closely spaced where cross-weaving of traffic will be involved, is conducive to hesitation and confusion—and a confused driver is a potential accident.

Signing needs restudy

One of the greatest needs at the present time is a complete reappraisal of present signing practice from the standpoint of freeway operation. Based on observation of a considerable mileage of eastern and mid-western freeways, the Willow Run or Industrial Freeway in Michigan is an outstanding example of the benefits of good signing practice for freeway conditions, with the Pennsylvania Turnpike not far behind. Their example should have more imitators.

I am also convinced that the best method available to a designer for checking the adequacy of an interchange design is to thoroughly analyze it from a signing standpoint. If the design can be properly signed and not violate the basic precept of one sign directive at a time with ample interval for the driver to react, you can generally be satisfied the design will operate satisfactorily.

Details are important

As our experience in California in interchange design has multiplied, certain basic precepts are beginning to emerge. One of the most significant of these is that certain design details have unusual importance from the standpoint of their operational effect.

For instance, up to a certain traffic volume, a two-lane inlet may be brought into a two-lane one direction freeway roadway with no resulting confusion, but when traffic volumes on the entrance road and the freeway reach a certain point, confusion and congestion result. As a consequence, we have adopted the practice of throating down the entrance road to a one-lane width entering the freeway, unless we are picking up an additional traffic lane ahead of the entrance, in which case it is a branch connection. As one of our designers has expressed it, we require the entering traffic to come in "one pea at a time." Fig. 4 represents our method of accomplishing this transition.

Parenthetically, we have made counts of traffic volumes during peak periods at such an inlet, where operating conditions were not of the best, and the inlet was accommodating entering vehicles at the rate of 1,450 per hour.

Fig. 4 also illustrates another design detail that we believe improves traffic operation at inlets. Examination of the sketch will disclose that the design definitely channels entering traffic to a parallel position with respect to the freeway lane, and thus the vehicles naturally use the ac-

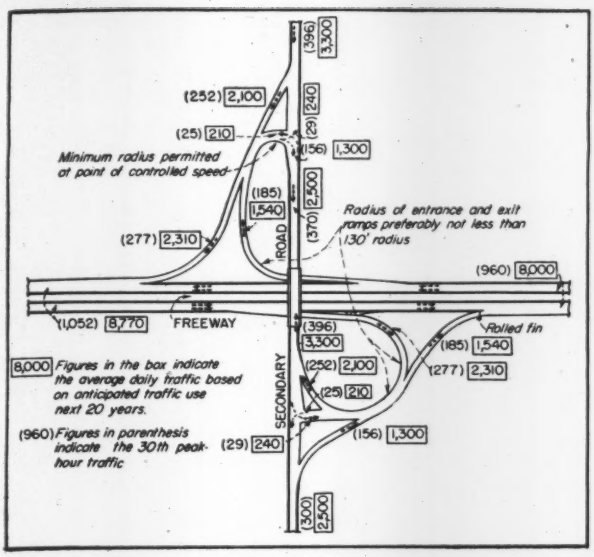

FIG. 5. WHERE AN INNER LOOP and an outer connecting ramp is used for connections between freeways and roads of secondary importance, lanes leading to the secondary road have short radius curves for left turns, thus compelling vehicles to move slowly as they cross traffic.

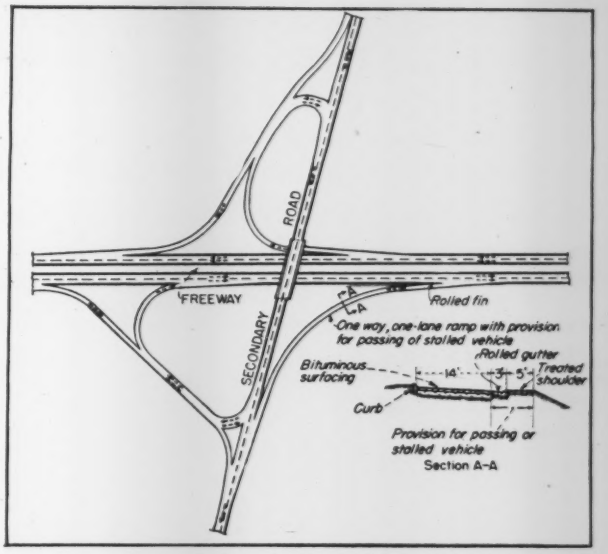

FIG. 6. THIS DESIGN WAS DEVELOPED to meet a situation where a one-lane width on a ramp to a freeway is sufficient for predicted traffic in one direction but where there must be provision for emergency passing. Provision for such passing is made on the lower right lane.

celeration lane to pick up speed before weaving into the main traffic stream. Sudden deflection of entering vehicles into high speed freeway traffic without benefit of acceleration lane use—permissible by some designs—in our opinion is both dangerous and unnecessary. The designer's function is to eliminate unsafe practices of this nature.

We frequently find the two quadrant semi-cloverleaf to be quite adaptable to interchanges with secondary roads or streets. Generally, such streets are carried over the freeway, and the natural form of the combined inner loop and outer connection ramps in such cases is elliptical in shape in order to connect the ramp to the secondary road at or near grade point.

Fig. 5 illustrates such a typical interchange.

The usual practice has been to connect the ramps on such relatively unimportant interchanges to both the freeway and minor road by minimum radius turns. Our experience has convinced us this is faulty design. We still believe that the connection to the *minor* road should be with minimum radius turns, because some of the movements at these points involve left turns which should be made at slow speeds under control conditions. The connections to the freeway, on the other hand, are another matter. Here, we believe the connection should be provided with the best radius possible and in no event with a smaller radius than 130 ft., if it can be avoided.

Long ramp connections

Every designer of interchanges has been faced with the problem of designing a long ramp connection where one-lane width is entirely sufficient for predicted traffic volume. However, to provide for emergency passing, the minimum width of such a ramp should be about 20 ft. This, in turn, is conducive to two-lane operation by traffic.

Fig. 6 illustrates a design and cross section we have developed for such situations. It consists of a 14-ft. paved roadway, utilizing a surface or pavement of a color contrasting with the main road lanes, generally of a bituminous type. Bordering the pavement is a concrete gutter 3 ft. wide with a flat roll type curb, that may be easily surmounted. Back of this gutter is a 5-ft. width of stabilized shoulder. Thus we provide sufficient width for emergency passes without encouraging two-lane operation or the dangerous practice of "racing for position" on the part of ramp users.

It may be of interest to note we have adopted this same type of rolled curb and gutter and stabilized shoulder construction for emergency parking borders on our urban freeways.

We are strong believers in the efficacy of contrasting colored pavements for entrance ramps and speed-change lanes as an aid in channelizing traffic at interchange entrances and exits.

Finally, I would like to offer the opinion that the fault most common to all complicated interchange designs results from a designer's attempt to provide for all possible interchange movements, no matter how minor or inconsequential the traffic diagram may indicate them to be. Unimportant movements should be required to occur at some other point, even at the expense of some circuity of travel rather than to add complexity to an otherwise sound design.

To the above should be added the thought that careful regard for aiding the public in determining the proper use of highway facilities should be a studious adherence to uniformity of design, particularly with respect to standardization of the various component parts involved in the details of design. Genius has been described as the capacity for taking infinite pains. Whether true of genius or not, it certainly applies to the design of a good interchange between crossing highways.

Colorado's New Highway Specifications Geared to New Construction Techniques

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COLORADO'S new state highway specifications—completely revised to incorporate contemporary advancements in highway construction—take full cognizance of the opportunities for securing better highways at reduced costs afforded by recent developments in construction equipment. This came about through cooperative effort and joint conferences between the state highway engineers and the Colorado Contractors Association prior to and during revision of the specifications.

The association believes that a great deal has been accomplished which will benefit both the department and the individual contractors doing the work. The main item that this association attempted to change was the continual repetition of the phrase "or as directed by the engineer". It was able to have this eliminated and the work to be done specified specifically so that the bidder will know in advance just what is expected of him, and nothing is left to different interpretations by field men.

Results specified, not methods

Inasmuch as almost every item was changed to some extent in the new draft, it is practically impossible to give a complete listing of the changes and to outline the improvements made thereby. In general, results are specified, rather than methods. Some of the more important improvements in the specifications are as follow:

A change in the gradation of materials for ballast, or mineral aggregate such as gravel and crushed rock for surfacing, was made to meet local conditions and to insure economy in preparation and use.

Methods for curing concrete were enlarged, based on standard practices, and contractors were given in option as to their preferences under certain basic conditions.

Surface finishes of concrete are determined for certain grades of work and are to be specified prior to the time of bidding.

The size of stone used for rubble masonry was revamped so that it could utilize one-man size units with the resulting appearance having a utility value rather than merely an artistic one.

The new specifications call for a definite revision upward for the basis of payment for force account work. Payments on a percentage basis were established for the purpose of including such items as supervision, additional bond, compensation insurance, old age tax and unemployment insurance, public liability, property damage, overhead and similar items.

Provision also was made for the payment on monthly estimates for materials produced on the project, but not necessarily incorporated into the job at the time of the payment.

Increased volume measurements for structural excavation were provided for, with the requirements for backfill materials eased and mechanical tamping arranged for on the basis of an hourly rate, if required. Unit prices, based on an estimate of requirements, are then made a part of the bidding proposal.

State controls compaction

In the case of compaction, the highway department retains responsibility for obtaining the necessary degree of compaction. Consequently, it specifies the type and size of roller, but the bid now is expected to include the amount of water and number of hours to be rolled. Also, the kind of roller desired and the number to be used is shown on the bidding blank and a price for furnishing them is submitted accordingly.

Removed materials are to be disposed of at certain designated places within limits, all to be indicated definitely on the plans.

In the case of piles, the lengths desired are to be shown on the plans. Test piling is to be paid for, as well as cut-offs and extra lengths spliced on. Jetting of piling also is permitted under certain conditions.

Pipe specifications changed

Requirements for the bedding of concrete pipe were changed and the payment is to be based on any one of several specified methods.

Corrugated metal pipe underdrains underwent considerable change. Backfill size requirements to meet local conditions were agreed upon, based on recent experiences and standard requirements.

Sizes, as well as percentage gradations for all materials were revamped. Likewise, concrete specifications, surface treatments of pavement and all incidentals such as fencing, handrails, guardrails, etc. were changed to meet common practices and standards.

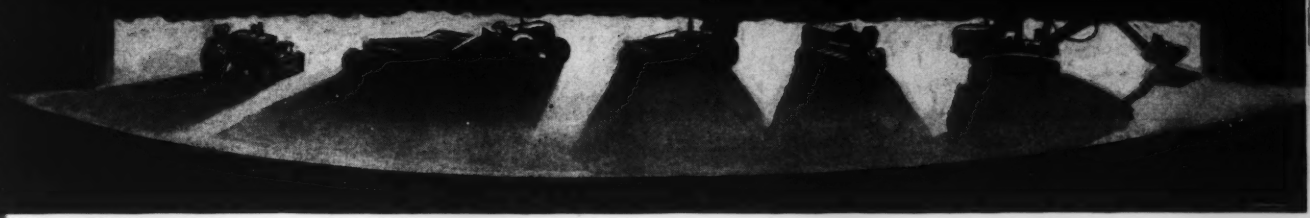
These are only a few of the changes, but they should give an idea of how the important ones were made so that the engineers and contractors alike would be on a more even basis of operation, with a greater and clearer understanding of the desires of the department. No doubt there are some inconsistencies which will appear from time to time and will have to be corrected. So far, however, the contractors as well as the highway department officials, are quite satisfied with the results of this cooperative effort in revising the Colorado State Highway Department specifications.

ENGINEERING NEWS-RECORD

Presents

A PREVIEW OF THE

1948 ROAD SHOW



BIGGEST ROAD SHOW ever held, and the first since 1940, is scheduled by the American Road Builders Association, July 16-24, at Soldier Field, Chicago. Here, spread over 1,250,000 sq.ft of exhibit space, will be shown the newest and latest in construction tools and equipment of all kinds. New and improved units will dominate most exhibits, some radically different from anything previously made. As a preview and reference, this special section presents an outline of exhibits, classified and indexed for easy reading.

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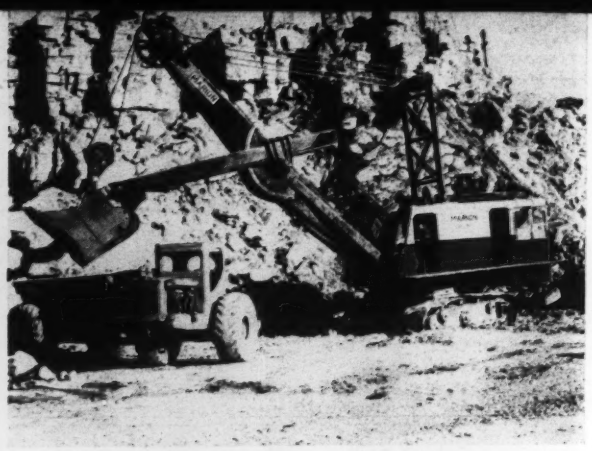
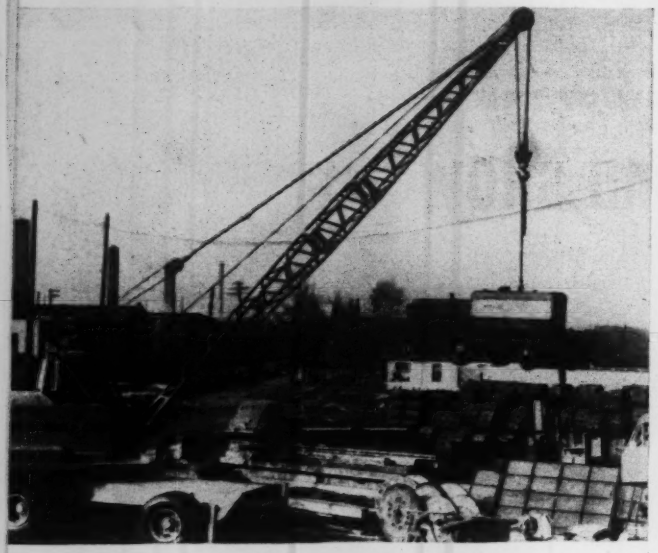
15. Miscellaneous Equipment RS-31

Road Show items received too late for inclusion in this special section are listed in the New Products *department of this issue.*

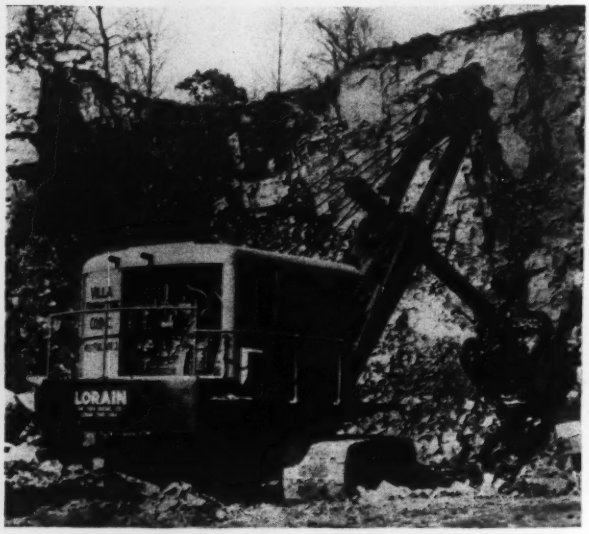
Insley ½-Yd. Shovel on Insley Lorry



Marion 111 M 3½- to 4-yd. Shovel



Unit 1520 Mobile Crane



Lorain 2-yd. 820 Shovel

1...Shovels and Cranes

The Insley Manufacturing Corp., Indianapolis, Ind.—Insley crawler or truck-mounted ½-yd. shovels have high swing speed to produce low cost yardage. The new Insley Lorry with ten speeds forward and two in reverse has been designed to carry the ½-yd. machine where easy maneuverability and quick trips between jobs are important.

Marion Power Shovel Company, Marion, Ohio — Developed for heavy-duty service, Marion 111-M is a 3½- to 4-yd. all-purpose machine whose operation is entirely controlled by air. Although essentially a clutch-type diesel machine, it has electric swing powered by a vertical motor driven by a generator direct connected to diesel driveshaft. The 33-M, smallest of Marion's line of shovels is a versatile rig whose size permits ready movement from job to job. Air controls make operation easy and accurate.

Unit Crane & Shovel Corp., Milwaukee, Wis.—New Unit 1520 is ¾-yd. mobile rig, self-propelled on 3-axle chassis with 6x4 drive. Like other Unit ½- and ¾-yd. machines, it is operated by one man, powered by one engine, has full-vision cab and is readily converted to shovel, crane, dragline or backhoe.

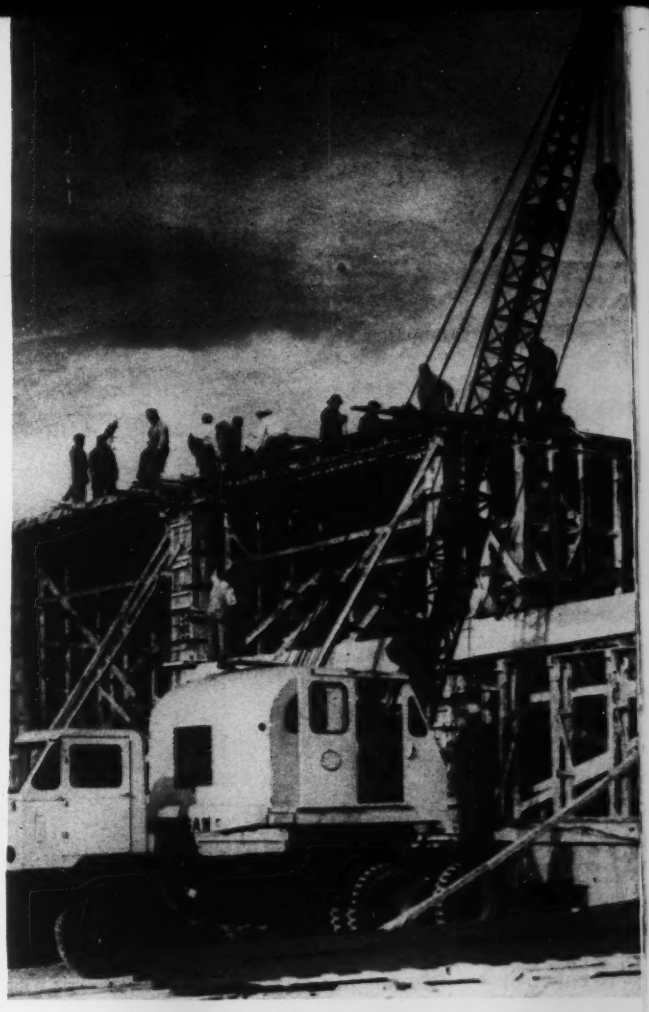
Thew Shovel Company, Lorain, Ohio—Hydraulic clutch on 2-yd. Lorain 820 shovel prevents engine stalling under any digging conditions, and cushions and absorbs shock to save machinery and cable. Turntable center-drive gives full concentration of power for any one operation or gives proper distribution of power over two or three simultaneous ones. Also on display are Lorain 41 hoe and TL 20 Moto Crane.

Schield Bantam Company, Inc., Waverly, Iowa—Full circle design and fast operating cycle give ½-yd Bantam shovel or dragline 60-yd. per hr. capacity. When fitted with trench hoe, unit digs 100 ft. of 5-ft. ditch per hr., and hoe bucket is interchangeable with Bantam's patented "mole's paw" for handling sticky material. Machine is ball-bearing equipped, has split type laggings for proper line speeds, and hook roller design that eliminates strain on center pin.

Michigan Power Shovel Co., Benton Harbor, Mich.—As pioneers in the truck shovel-crane field, Michigan's ⅜- and ½-yd. excavators and

Schield Bantam 1/3-yd. Shovel on Half-Track

Bay City 20-Ton Crane Mobile



Michigan Truck Crane

6- to 12-ton cranes are largely rubber-mounted, with high mobility and road speeds up to 30 mph. Designed and built as a unit, with chassis integrated with turntable mechanism, the machine can handle the usual front end attachments. Clutches are air-controlled.

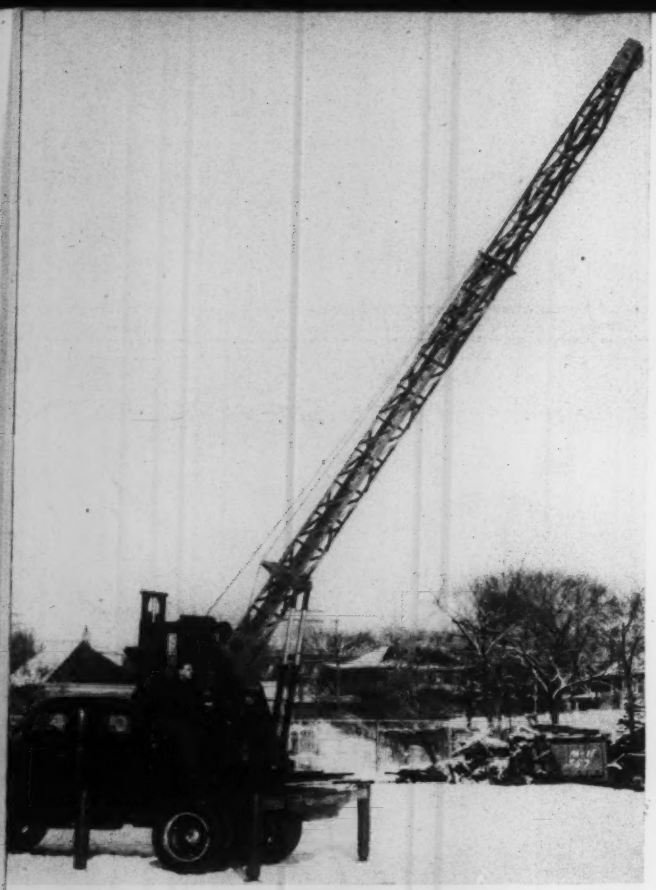
Bay City Shovels, Inc., Bay City, Mich.—Model 180-T66 CraneMobile is 20-ton crane on specially designed 3-axle, all-wheel drive carrier unit. Heavy-duty machine is powered by 517-cu. in. displacement Waukesha 6-cylinder engine and features independent boom hoist, power load lowering device and triple end sheave and hook block. It is essentially an erecting crane and handles boom and jibs up to 110 ft. Crawler Model 30 backhoe, rated as 6-ton crane and ½-yd. shovel, has 17-ft. boom and 36-in. cutting-width dipper. Model 30 is fully convertible to shovel, crane, clamshell, dragline or hoe. Similarly convertible is Model 65, a 1¼-yd. shovel with 20-ton crane rating. Shovel has 21-ft. boom, 16-ft. dipper sticks, chain crowd.

Milwaukee Hydraulics Corp., Milwaukee, Wis.—All-hydraulic operation of new larger H3 Hydrocrane, nominally rated 3 tons or ⅜-yd. capacity, eliminates conventional gears, shaft, drums, clutches and sprockets. Truck-mounted rig has hydraulic telescopic boom, improved metering valves for precision control and hydraulically-operated tandem outriggers which support entire weight of cranes when working. Gasoline consumption is only 5 to 10 gal. per day.

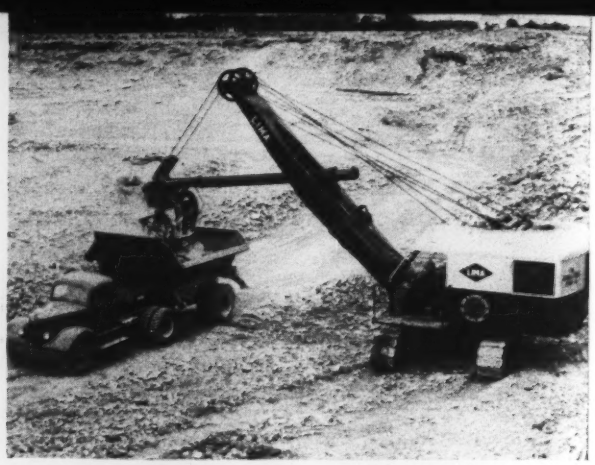
Lima Shovel & Crane Div., Lima-Hamilton Corp., Lima, Ohio—Electric or diesel-powered Lima 604 is convertible to 1½-yd. shovel, 30-ton crane or dragline. Box-type boom is welded steel and dipper handle is single unit with one-piece rack and independent chain crowd. Four conical hook rollers support rotating unit, whose frame is welded steel. Air control on all major functions makes the 604 a smooth, precise machine.

Quick-Way Truck Shovel Co., Denver, Colo. — Model E 4/10-yd. shovel for mounting on any standard 5-ton truck and ¼-yd. Model J for 1½-ton unit both feature low initial investment and maintenance costs, high operating speed and quick convertability. With the many different attachments, machines handle wide variety of jobs.

Wayne Crane Division, American Steel Dredge Co., Inc., Fort Wayne, Ind.—Quickly convertible to 5-ton crane, ½-yd. trench hoe, dragline, clamshell or ½-yd. shovel, Model 22 Wayne crane is rubber-mounted, one-man operated machine. Powered by single 8-cylinder gasoline engine developing 62 hp. at 1,800



Milwaukee 3-ton Hydrocrane



Lima 1½-yd. 604 Shovel

P&H 2-yd. 855B Shovel

rpm., or by comparable diesel engine, rig can move, lift, boom and swing simultaneously or independently. Four dual sets of pneumatic tires, and drives on each of wheels, give exceptional mobility and speeds up to 10 mph. as well as ample traction for off-road-work. Hydraulic steering, 7-ft. 8-in. wheelbase and 22-ft. turning radius make tight work easy.

Harnischfeger Corp., Milwaukee, Wis.—P&H 2-yd. 855B excavator is easy to transport without dismantling. Planetary chain crowd gives full power for crowd and rapid reversal, with dipper return twice that of crowding speed. Independent planetary boom hoist for crane operation gives great safety and accurate spotting or lowering of load. Low-pressure hydraulic control cushions mechanism against shock and is easier on the machine and operator. Others in P&H line are ½-yd. Model 150 shovel, and two ¾-yd. 255-As, one equipped as trench hoe, one as truck crane with extra long boom.

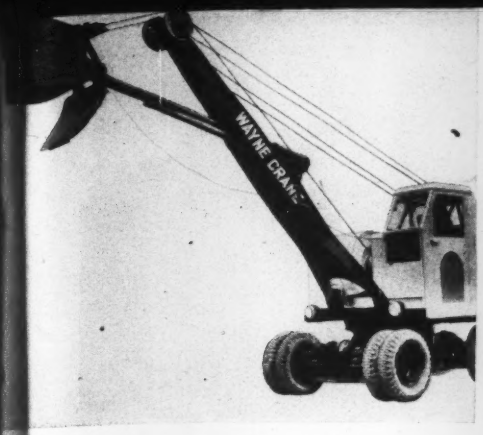
Koehring Company, Milwaukee, Wis. — Same boom on Koehring ½-yd. heavy-duty 205 machine handles shovel dipper or backhoe arm, thus cutting conversion time and attachment costs. Chain-driven double-cable crowd gives shovel dipper extra power for tough digging, while low center of gravity well behind center of rotation steps up digging stability. As machine has independent traction, crane-rigged 205 can swing and hoist boom or load while traveling. Making its debut is Koehring's new 2½-yd. Model 1005 shovel which has just completed 12 months of field tests.

Gar Wood Industries, Inc., Findlay Div., Findlay, Ohio—Hydraulic coupling combined with 65-hp. diesel or gasoline engine, and dual universal joints connecting coupling and main drive shaft, let improved ¾-yd. Buckeye 70 shovel perform smoothly under all loads. Fingertip controls make it easily operated, and front end conversion units make it a versatile machine.

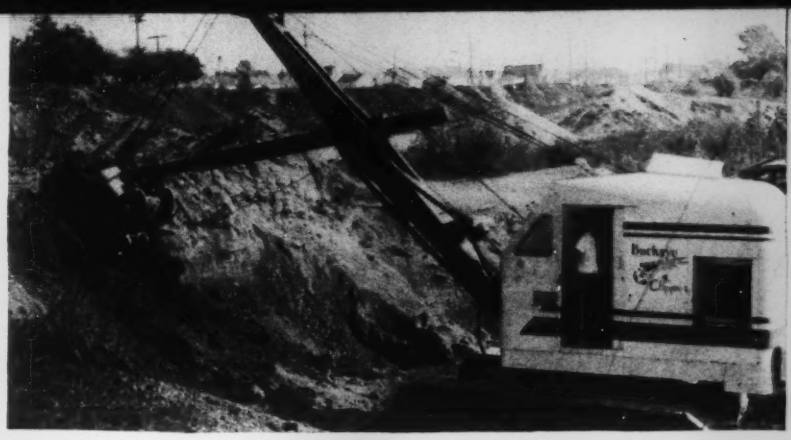
Osgood Company, Marion, Ohio—Model 1000 is combination 2½-yd. shovel, crane and dragline, and as one of largest and newest Osgood machines it incorporates Osgood's air-control and air-cushion clutches. At other end of line is ⅜-yd. Model 50, a combination machine with patented wire-rope crowd.

Austin-Western Co., Aurora, Ill.—The ¾-swing design of Badger ½-yd. crawler shovel not only makes close-quarter work easy by eliminating tail swing, but also greatly reduces swinging weight and thus increases work output. Center of gravity is lower; digging power greater. Easily converted to crane, dragline, pile driver, skimmer or trench hoe, Badger is quickly transported from job to job by special wheel mounts.

Hanson Clutch & Machinery Co., Tiffin, Ohio — Fully-convertible Hanson Model 31 diesel powered ⅜-yd. shovel or 4½-ton crane has internal-expansion booster-type clutches on hoist and crowd, and disk clutches on swing. Shovel boom is welded, one-piece alloy steel with friction-controlled chain crowd. Steering of the crawler rig is air-controlled. Model 41 is similar welded machine with capacities of ½ yd. as shovel and 6½ tons as crane.

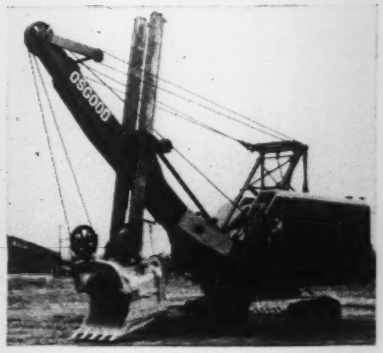


Wayne Crane Shovel

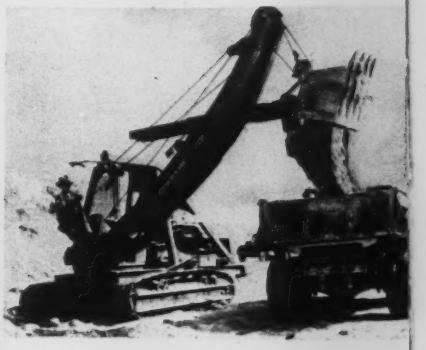


Buckeye Model 70 Shovel

Koehring 205 Pull Shovel



Osgood 2½-yd. Model 1000 Shovel



Austin-Western Badger Shovel

2...Tractors and Equipment

Isaacson Iron Works, Inc., Seattle, Wash.—With cable and hydraulic Trac-Dozers, Super-Rooters, Klearing blade, Winchoist and cable power units, Isaacson has a matched line of equipment for all models of International tractors including big TD-24. Equipment has been streamlined, simplified and improved for maximum work output and operating economy.

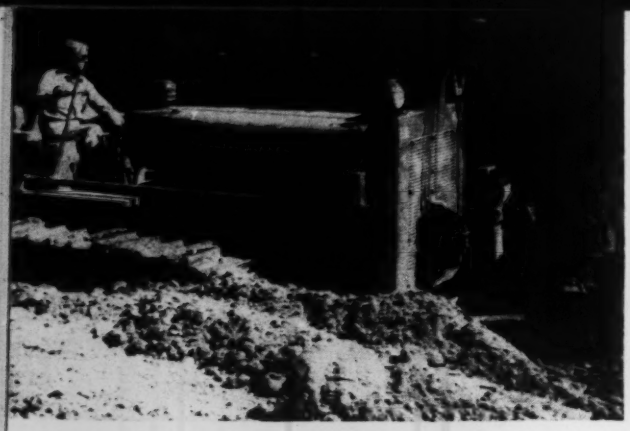
M-R-S Manufacturing Company, Flora, Miss.—Called world's largest and most powerful rubber-tired towing tractor, new M-R-S 125 weighs 13,700 lb. and develops 109 drawbar hp. Powered by IH 6 cyl. diesel, and with 70 percent of weight concentrated on low-pressure drive tires, tractor can handle Mississippi wagon and other large size equipment such as dozers, scrapers and rollers. Six optional speed and power ranges are available to fit tractors to job. Maximum speed in high range is 37 mph.; maximum tractive effort in low range is 19,500 lb.

International Harvester Company, Chicago, Ill.—With 180 hp. at flywheel and 140 at drawbar, International's TD-24 crawler tops their fleet of track-type and wheeled tractors. Big rig has eight forward and eight reverse speeds, synchromesh transmission and quick reverse shift which bypasses speed-change gears to permit instant change in direction. Planet power gearing under fingertip control puts power on both tracks for greater drawbar pull on turns, or locks one track for pivoting. Matched equipment is available for TD-24 and all other International tractors.

Contractors Machinery Co., Inc., Batavia, N. Y.—Parallel-lift mechanism is patented feature of Trojan angledozers and bulldozers for International wheel-type tractors. Linked lever device always keeps blade cutting angle constant in best operating position, yet has high blade lift and full axle clearance. Angledozer blades are up to 114 in. long and have seven different positions.

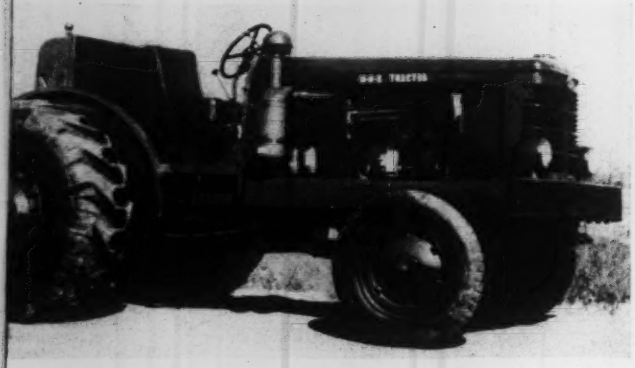
Hyster Company, Portland, Ore.—Hyster winches for rear mounting on D2 through D8 Caterpillar tractors are of four general types, each of which converts tractor to mobile hoist or towing unit. Hyster towing winch is single drum, reversible direct geared unit which increases drawbar pull from 50 to 80 percent. Where two cable lines are needed, Hyster tractor donkeys or double-drums give two operating speeds on both friction-driven units. Worm-drive winches have high line pull with low speeds essential for close control for accurate spotting or for towing heavy equipment over muddy ground. Hyster utility winches for D2 and D4 tractors have large cable capacity, and smooth clutch and brake action.

Bucyrus-Erie Co., South Milwaukee, Wis.—Keeping pace with tractor developments, Bucyrus-Erie has a complete line of equipment for International's new TD-24 crawler. Bulldozers and bullgraders are cable controlled, with large sheaves placed well out of

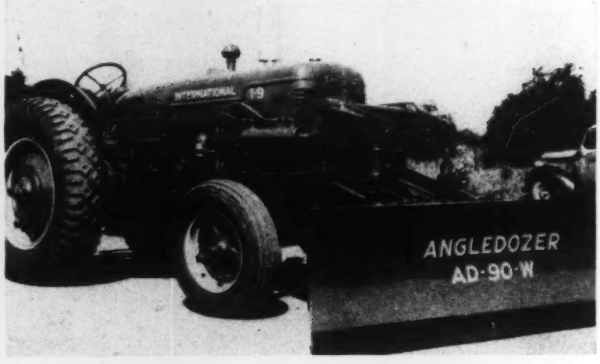


Isaacson Angle-Blade Trac-Dozer

International TD-24 Tractor



M-R-S 109-hp. Tractor



Trojan Parallel-Lift Angledozer

the way of dirt. Blades are high tensile alloy steel with reversible cutting edge. Power control winches for front or rear mounting on the TD-24 are also available. Similar cable or hydraulic equipment for smaller International tractors is rounded out by the Bucyrus-Erie Dozer-Shovel, a hydraulically operated combination that is quickly changed from bulldozer to tractor shovel.

R. G. LeTourneau, Inc., Peoria, Ill.—First in the field with rubber-tired high-speed bulldozers, Tournadozer has 4-wheel drive with forward and reverse speeds up to 15 mph. Constant mesh transmission eliminates shifting and gives instantaneous speed selection without loss of momentum. Controls are finger-touch type. Rear-mounted engine lets operator keep good view of cable-controlled blade. Engine of 25-ton B Tournadozer develops 300 brake hp. at 1,800 rpm.; 15½-ton C Tournadozer develops 180. Larger model rides on 24.00x29-in. tires.

Heil Co., Milwaukee, Wis.—Rear-mounted Heil S power control units, designed for 50 to 100-hp. tractors, are all-purpose units for one-or two-line control of cable-operated equipment. Large diameter brake and clutch drums eliminate operating shocks and dissipate heat rapidly. Large diameter, wide-swinging fairlead sheaves and level-winding reaving sheaves reduce cable wear. Line pull is 8,000 lb. on bare drum; 4,500 when full. Also in Heil line are front-mounted power control units, and hydraulic and cable-controlled bulldozers and angling Trailbuilders with blades up to 14 ft. wide.

Minneapolis-Moline Power Implement Company, Minneapolis, Minn.—MM Industrial tractors feature easy steering through anti-friction bearings, heavy-duty Ross steering gear and advanced front-end design. Front axle capacity of 49-hp. model UTI is 10,000 lb., and that of the 27-hp. model RTI is 5,000 lb., so tractors can handle heavy load with wide variety of front-end equipment. Both tractors are powered by 4-cylinder MM gasoline engines with displacements of 283 and 165 cu. in. respectively. Model UTI is 126 in. long, 95½ in. wide with dual tires, has 79½-in. wheelbase and 16-ft. turning radius. Corresponding figures for RTI are: 104 in., 87 in., 66½ in., and 12 ft.

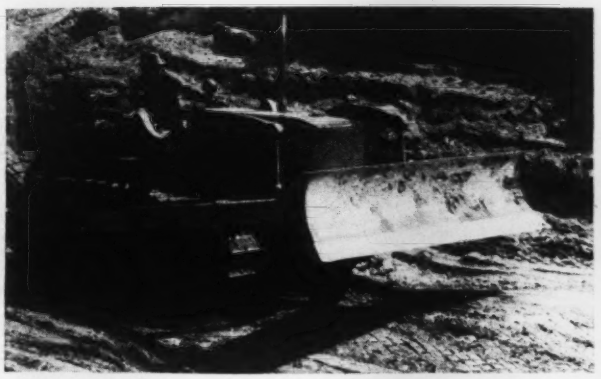
Baker Manufacturing Co., Springfield, Ill.—Big Baker bulldozer is especially designed for new Allis-Chalmers HD-19 tractor. Unit is hydraulically or cable operated, as is angling Gradebuilder developed for same rig.

Pacific Car & Foundry Co., Renton, Wash.—Two-way side frame trunnion that takes up side-frame twist while blade is tilted and which allows one man to attach or detach blade, is new item on Carco cabledozers and hydradozers. Angling models have 20-deg. cutting angle adjustment while blade is angled, tilted or straight. Other items are Carco winches and power control units.

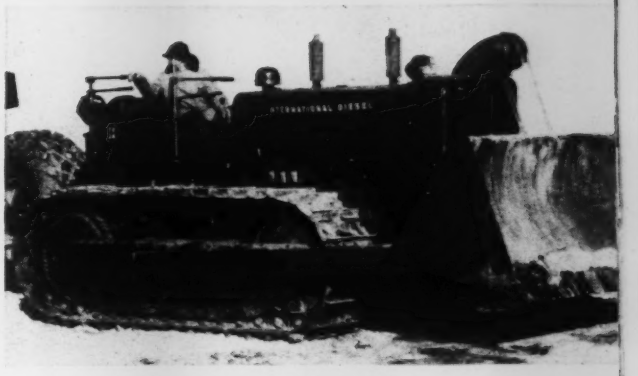
Al Evans Winches, Inc., Gloucester, Va. — Al Evans tractor-mounted winch, designed primarily for tree pulling and land clearing, handles heavy hoisting with ease. It can run continuously under heavy load, and speed range is wide as it has controlled speeds in winch itself in addition to those at source of power. High brake efficiency lets winch lower

Hyster D7L Tractor Donkey

Model C Tournadozer



Bucyrus-Erie Hydraulic Bullgrader



Heil Bulldozer

load slowly even when tractor engine is stalled.

La Plant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa—La Plant Choate enters field with new TD-300 Motor Dozer—a 4-wheel drive, 4 wheel steer bulldozer on 24:00 x 29 tires. Buda 225-hp. diesel engine drives 47,000-lb. machine through two 4-speed transmissions for total of eight speeds forward, 1.7 to 22.5 mph., and two reverse. Big rig has gasoline starting engine, Atwood clutch, Fuller transmissions, and hydraulic steering and blade control.

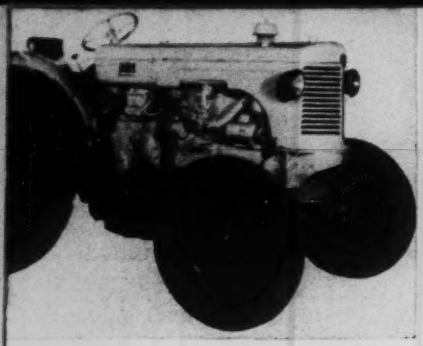
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Heading Allis-Chalmers line of wheeled and crawler tractors is recently-introduced 20-ton HD-19 diesel with hydraulic torque converter drive. Rig is powered by two-cycle GM diesel engine developing 163 hp. at flywheel. Liquid drive design gives infinite number of speeds in only two ranges—0 to 3 in low gear and 0 to 7 in high. The HD-19 is built for easier control and greater operator comfort and, in addition to the torque converter which eliminates most shifting, has hydraulic finger-tip steering, self-energizing brakes, comfortable foot rests and adjustable seat and brake pedals. Another versatile crawler is Allis-Chalmers 37½-hp. diesel HD-5 which weighs 11,000 lb.

Drott Manufacturing Corporation, Milwaukee, Wis.—Twin-control on Drott bulldozers or angledozers lets operator raise or lower either side of blade independent of other while tractor is in motion or standing still. Positive down pressure is similarly controlled by closed hydraulic system which keeps dirt out, oil in. Blade is mounted close to radiator for better operator vision.

The Oliver Corporation, Cleveland, Ohio—Largest of Oliver's industrial and crawler tractors is 120-hp. diesel Cletrac FDE. Drawbar pull varies from 28,000 lb. in first gear to 7,150 lb. in fourth gear; corresponding speeds are 1.6 and 5.0 mph. Six-cylinder engine displaces 895 cu. in. and has electric starting. Track-shoe width of 20 in., and 96 in. of track on ground for a total contact area of 3,840 sq. in. give 15-ton tractor a unit pressure of 7¾ psi.

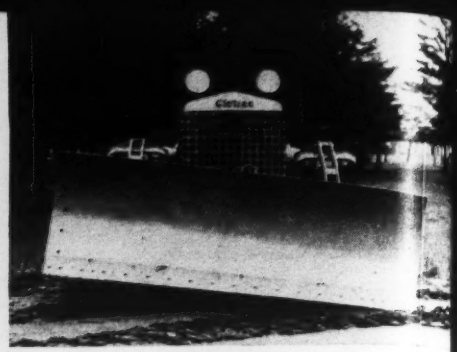
3...Carrying Scrapers

Henry Manufacturing Company, Inc., Topeka, Kansas—Hydraulic two-wheel scrapers with capacities 1 to 5 cu. yd. have double-acting cylinders for positive penetration of cutting blade, rear-dump action and self-cleaning bowl. Entire weight of scraper can be made to rest on high carbon cutting blade when pan drops to loading position, where flat digging angle lets material enter bowl with minimum draft. With new bank shaving attachment, welded steel scrapers can cut ditches with ver-

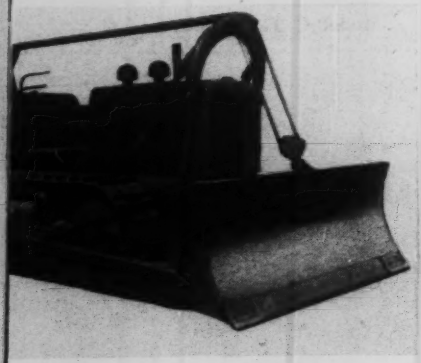


M-M 49-hp. UTI Tractor

Al Evans High Speed Winch

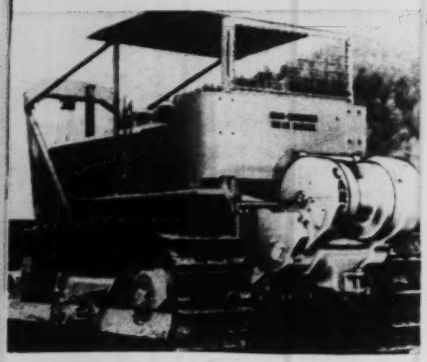


Drott Bulldozer

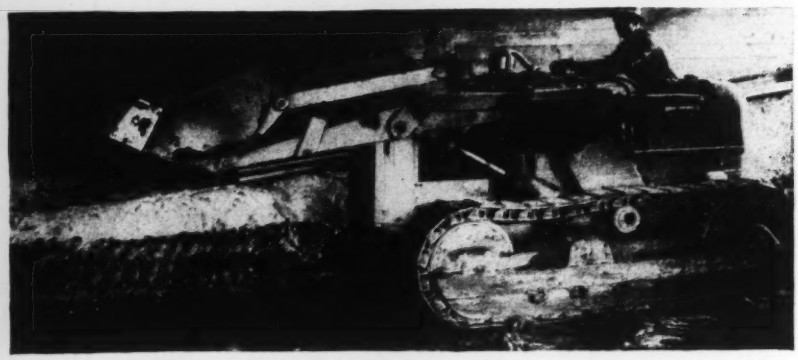


Baker Bulldozer for HD-19

LaPlant Choate TD-300 Motor Dozer



Carco Cabledozer and Winch



Allis Chalmers HD5 Tractor

tical sides regardless of depth of cut. Device is pair of spring-loaded steel disks projecting beyond the scraper tire to slice bank and roll the material into path of next cut.

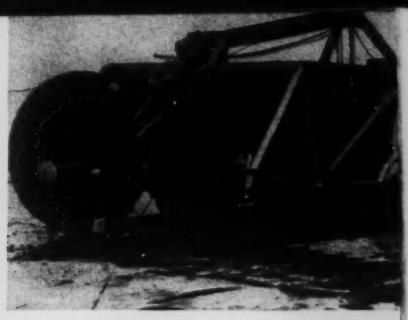
Bucyrus-Erie Co., South Milwaukee, Wis.—Four new improved cable-controlled Bucyrus-Erie four-wheel scrapers have struck capacities of 4, 6, 8, and 10 cu. yd. Improvements in the S-series scrapers include increased maneuverability, low center of gravity, a hinged apron with adjustable opening for clean discharge of sticky material, straightline cable reeving, and positive bowl return. Double-curve cutting edge boils dirt into center of bowl with minimum compaction, while ejection is of positive rolling type.

R. G. LeTourneau, Inc., Peoria, Ill.—New Tournapull features electric control whereby operator merely pushes button on dash to raise or lower bowl, bring apron up or down, move tailgate forward or back, or to turn rig. Model B Tournapull with matched 30-yd. Carryall is powered by 225-hp. supercharged 6-cylinder diesel with four speeds forward up to 16 mph. Combination has 37½-ft. length, 11½-ft. width and 24-ft. wheel base. Turning radius of 22-ton rig is 16½ ft. minimum.

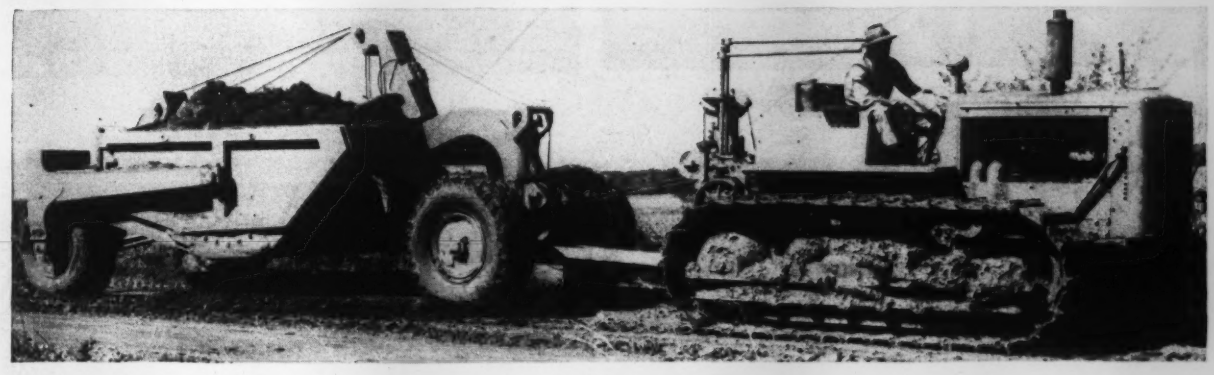
Gar Wood Industries, Inc., Findlay Div., Findlay, Ohio—Redesigned Gar Wood 4-wheel drawn scrapers with 7.6- to 28-cu. yd. heaped capacity are welded heavy-duty rigs with low center of gravity and high carrying position for increased stability on rough ground. Positive digging to depth of 12 in. below tire level, and boiling loading action fill bowl and apron evenly.

Wooldridge Manufacturing Company, Sunnyvale, Calif. — New high-speed, self-propelled Terra-Cobra powered by 200-hp. Cummins diesel engine has 14-yd. struck capacity and 17½-yd. heaped. Rig shows conservatively rated performance record of 24,-000-lb. rim pull at 2.6 mph. in first gear or reverse and up to 3,800-lb.

Henry 3-yd. Scraper



Car Wood 28-yd. Carrying Scraper



Bucyrus-Erie 6-yd. Scraper

Le Tourneau B Tournapull

Wooldridge 200-hp. Terra-Cobra

rim pull at 16.8 mph. in fourth gear. Large 17-in. single-plate, dry-disk clutch automatically compensates for facing wear, while constant-mesh high-capacity helical gears permit faster shifting. For maximum maneuverability, Terra-Cobra has positive hydraulic two-wheel steering, universal oscillating pivot, centric load balance, and rear-wheel air brakes to prevent jack-knifing.

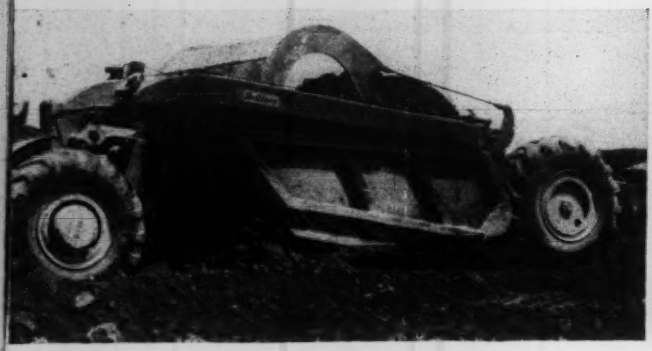
Be-Ge Mfg. Co., Gilroy, Calif.—Now available in two sizes—4.2 and 2.6 yd. struck, 5.4 and 3.2 yd. heaped—Be-Ge Speedhaul scrapers have full hydraulic control, positive bowl ejection and powered apron that rises independently of the bowl. Two cylinders on the cutting blade furnish power for digging and lifting. Two-wheel Series SS Speedhaul is designed for use with Case industrial tractors; four wheel Series ST with Caterpillar D2 and D4 crawlers. Tires and wheels of both types may be changed without removing axle from frame.

Heil Co., Milwaukee, Wis.—New Heiliner, 2-wheel rubber-tired diesel tractor and 2-wheel scraper combination, features hydraulic steering through action of two opposed, double-acting cylinders direct-connected between tractor and trailer unit. Hydro-steer holds tractor at any desired turning angle up to 65 deg. whenever steering wheel rotation is stopped, and gives rig minimum turning radius of 22 ft. Engine of Heiliner develops 150 hp. at 1,900 rpm.; gives speed up to 21 mph. Open-top, twin-cable 16½-yd. scraper behind tractor has a low center of gravity, high ground clearance and cutting blade that boils material into bowl. Wide-opening front apron, synchronized with tilting-floor push-out discharge speeds unloading.

LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa—New LPC self-propelled equipment group includes 15-yd. bottom dump wagon as well as 9-and 14-yd. Motor Scrapers. Big scraper carries 17½-yd. heaped loads at speeds up to 18 mph. Powered by

Be-Ge 2-wheel Speedhaul Scraper

La Plant-Choate Motor Scraper



Heiliner 16½-yd. Tractor-Scraper

Isaacson 8- to 15½-yd. Karry-Skraper

225-hp. Buda diesel in 2-wheel hauling unit, Motor Scraper has positive, double-acting hydraulic steering for safe turns up to 60 deg. without danger of jack-knifing. Improved air-actuated power control unit operates scraper, which has curved offset cutting edge for better penetration, and positive forced ejection from bowl.

Isaacson Iron Works, Seattle, Wash.—Engineered for balance, with low center of gravity, Isaacson cable-operated Karry-Skrapers for hauling by International tractors range up to 24-yd. heaped capacity unit for TD-24. All welded scrapers turn in own length. Self-aligning fairleads and tubular housing that protects cables and sheaves prolong cable life. Wide-opening front gate lets self-sharpening digging blade load scraper full in short distance, and lets positive ejector dump load fast.

4...Excavators and Loaders

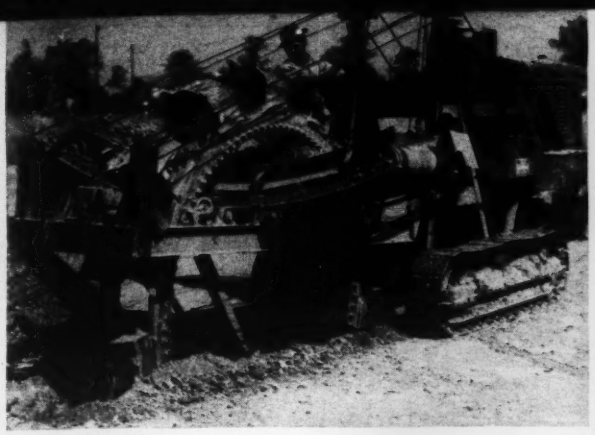
Cleveland Trencher Company, Cleveland, Ohio — Full-crawler wheel-type Cleveland trenchers cut ditches for all purposes in all types of ground. Units feature handling ease, high power, low fuel and maintenance cost and quick field repair.

Parsons Company, Newton, Iowa — Newest of Parsons wheel-type Trenchliners is utility-size model 80, for fast excavation of off-street service connections. Larger model 200, for drainage and pipeline work, features 50 digging speeds up to 20 ft. per min., and digs a 5½-ft. trench 15 to 26 in. wide. Power is from 55-hp. gas or 53-hp. diesel engine. Ladder-type Parsons 221 with 45-hp. diesel or 54-hp. gasoline engine digs 16 to 36 in. wide, 8½ ft. deep, with 25 diggings speeds from 2 to 118 in. per min.

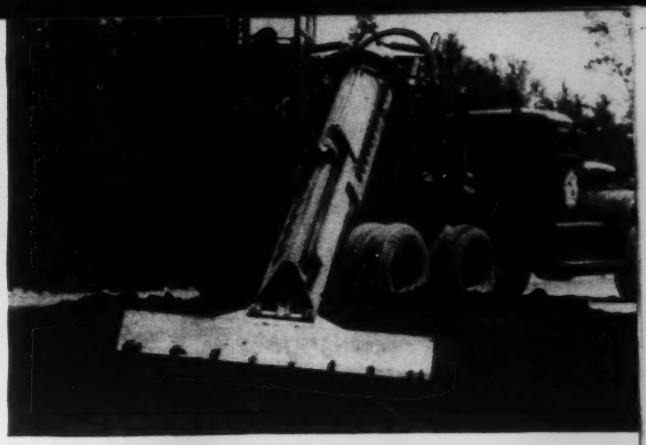
Warner & Swasey Co., Cleveland, Ohio — Gradall, multi-purpose earthmover, is all-hydraulic controlled for precise operation. Designed for truck mounting, rig has 360-deg. swing, and 24-ft. telescopic boom in double-ring assembly so entire boom can tilt 45-deg. from horizontal and be raised 22 deg. or lowered 44. Bucket at end of boom operates through 116-deg. vertical arc and may be held easily in any position within that range.

Athey Products Corporation, Chicago, Ill.—Loading in front, dumping overhead to rear, Athey ML4 Mobiloader on Caterpillar D4 crawler operates in straight line cycle, shuttling back and forth from bank to truck. Digging and loading up to 150 cu. yd. per hr., overhead tractor-loader is twin-cable operated under finger-tip hydraulic control.

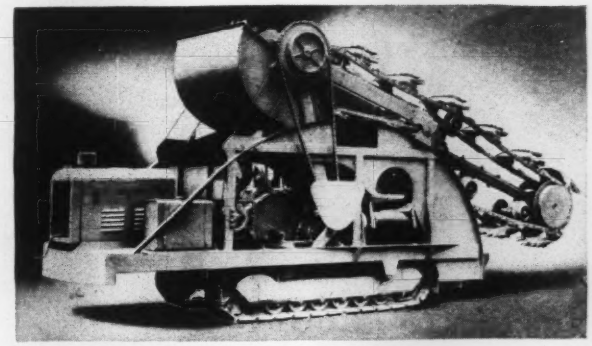
Frank G. Hough Co., Libertyville, Ill.—New control on all Hough tractor shovels raises, lowers, dumps and retracts bucket entirely by hydraulics. In addition to ¾-, 1- and 2-yd. shovels for mounting on International Har-



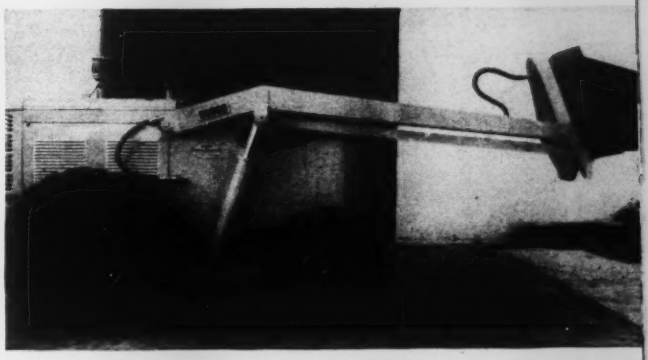
Cleveland Trencher



Warner & Swasey Gradall



Parsons 221 Trenchliner



Hough Payloader with Extra-Long Boom

vester crawler tractors, Hough line includes various Payloaders—rubber-tired tractor-shovels designed and built as unit. New 1½-yd. Payloader features all-wheel drive on large tires.

Hyster Co., Portland, Ore. — Mounted on rear of Caterpillar D7 tractor, Hystaway crane with 30-ft. live boom is handy ½-yd. dragline with 240-deg. swing at 4.5 rpm. Unit has same capacity at rear or sides, conventional shovel controls, and can be attached to tractor by two men in 2 hr. Crawler retains full mobility and unrestricted track oscillation, but simple locking device makes track rigid for full counterweighting when needed. Hystaways with 25- and 35-ft. booms as ⅜- and ½-yd. draglines on D6s and D8s, respectively, are also made.

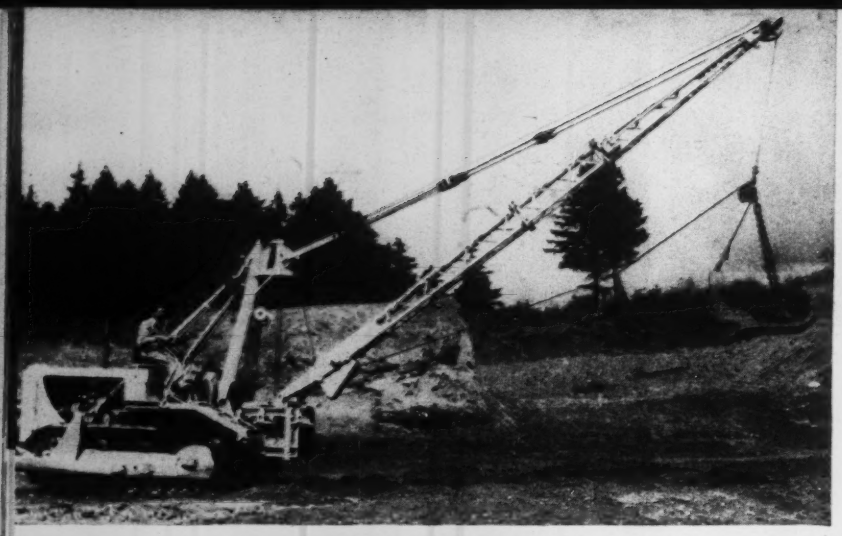
Gar Wood Industries, Inc., Findlay Div., Findlay, Ohio—Buckeye 312 ditcher with 67-hp. diesel engine digs 6-ft. trench 16 to 30 in. wide. Crawler wheel-type ditcher has digging speeds up to 57½ ft. per min. and 4 forward and 4 reverse road speeds. Buckeye 51 ditcher for heavy-duty pipeline work cuts 51 in. wide by 8½ ft. deep. With 110-hp. diesel, rig digs smooth-bottom, level ditches at speeds from 1.3 to 35.0 ft. per min. Automatic safety brake holds ditcher on grades when power stops.

Barber-Greene Co., Aurora, Ill.—A handy rig for digging pipe and conduit trenches is the new B-G Runabout Model 705 ditcher that makes a cut 5½ in. wide and up to 4 ft. deep. Completely new, the machine is wheel-tractor mounted for easy portability, with a road speed of 15 mph. Another new ditcher is the B-G Model 720 for trenches 8 to 11 in. wide, 4 ft. deep. Big brother to these is the well known Barber-Greene Model 44-C general service, vertical boom ditcher—a heavy-duty rig that digs 12- to 24-in. trenches 8 ft. 3 in. in depth.

Lull Manufacturing Company, Minneapolis, Minn. — Challenger loader is hydraulic loading attachment for industrial wheel-type tractors, and has lifting capacity from 1,750 to 6,000 lb. 5M Challenger with ¼-yd. bucket can be mounted on Case VAI tractor in an hour and removed in 30 min. Also designed for wheel-tractor mounting are Lull Shoveloaders with 2,500, 4,000 or 6,000-lb. capacity. Hydraulic bucket-control cylinders produce shovel-like action with power crowd for digging hard material below front end of tractor.

White Manufacturing Company, Elkhart, Ind. — White front-end loaders for industrial-type tractors are readily applied to machines and mechanically operated from front of engine. Loaders have extensible boom which moves bucket forward at top of travel for spotting discharge in truck body.

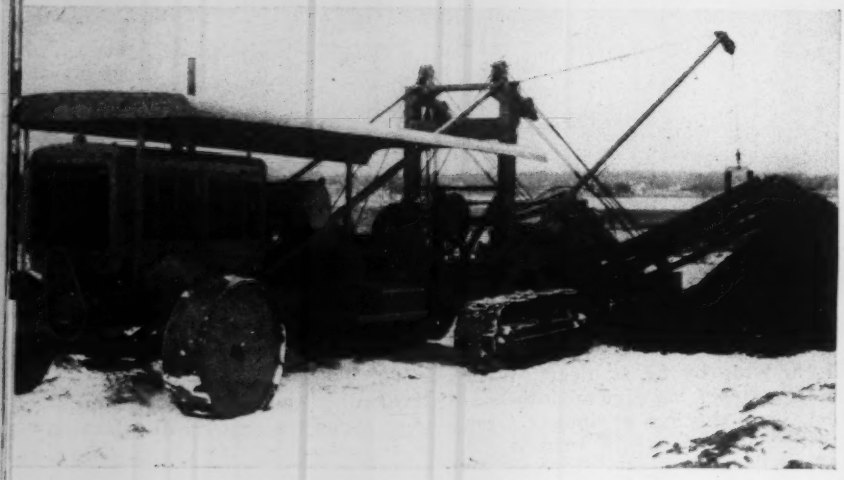
Euclid Road Machinery Co., Cleveland, Ohio—Tractor-drawn Euclid Loader is plow-type rig for fast mobile digging and loading of practically any material from loose sand to hard clay and shale. Wide cutting blade and moldboard plow send steady flow of material to 54-in. belt driven by 150 or 190-hp. diesel engine mounted at rear. Maximum cutting depth is 24-in., and grading cuts can be made up to 9½ ft. wide. Through three control levers, pulling-tractor operator hydraulically controls belt and adjusts cutting blade for angle and depth of cut.



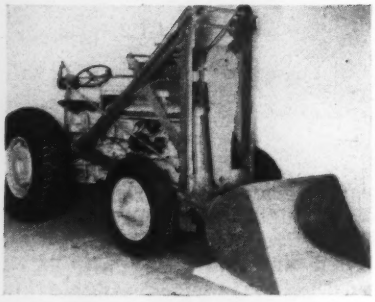
Hyster Hystaway ½-yd. Tractor Dragline

Barber-Greene 705 Runabout Ditcher

Lull Shoveloader



Buckeye Heavy-Duty Pipeline Ditcher



White Front End Loader

5...Haulage Units

Maxon Construction Co., Inc., Dumpcrete Div., Dayton, Ohio—Special utility body for hauling air-entrained concrete, Dumpcrete has hydraulic hoist that holds 2-, 3- or 4-yd. body at any point up to maximum 90-deg. dumping angle. Controlled discharge through positive cut-off gate, discharge height up to 6 ft., and 180-deg. tail chute swing are other features. All welded of low-alloy steel, bodies have internal baffle that retards concrete surging in transit.

Euclid Road Machinery Co., Cleveland, Ohio—Euclid's off-highway hauling equipment includes side- and bottom-dump wagons and rear-dump trucks. Among newest models are: 30-ton LD rear-dumper with 25-yd. struck capacity, 275-hp. diesel engine and 24-mph. road speed; and 25-yd. LDT bottom dumper. Latter is six-wheel tractor-trailer unit.

Dodge Div., Chrysler Corp., Detroit, Mich.—Improved weight distribution in new Dodge truck has been achieved by moving front axles back and engine forward. Wheel bases have been reduced 6 to 8 in., but cab-to-axle dimension remains practically unchanged. Front and rear axles have increased load-carrying capacity, and turning angle is now 37-deg. in both directions.

Sterling Motors Corp., Milwaukee, Wis.—Featured in Sterling's fleet of trucks for contractors are two models powered by Waukesha engines for 5-cu. yd. dump bodies, and two Cummins-powered units for mounting Rex 5½-yd. horizontal MotoMixer.

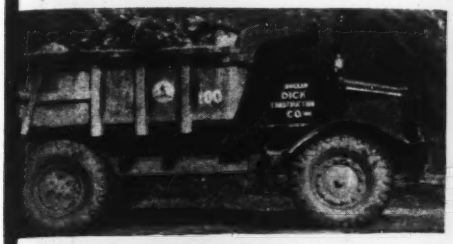
Willys-Overland Motors, Inc., Toledo, Ohio—Powered by famous 134-cu. in. 60-hp. Jeep engine, Willys-Overland Jeep truck with selective two- or four-wheel drive is useful machine around any construction job. With six speeds forward and two reverse, 118-in. wheelbase 1-ton truck will travel over almost any ground. Optional rear power take-off is available to drive belt or shaft-driven equipment.

Athey Products Corp., Chicago, Ill.—Tractor-drawn Athey Forged-Trak side dump trailers with up to 19 sq. ft. of ground contact area beneath treads have high flotation on soft ground. On easier terrain, Athey PD-10 rubber-tired 2-wheel trailer behind high-speed Caterpillar DW-10 4-wheel tractor carries 10½ yd. heaped, a maxi-

Maxon Dumpcrete Body

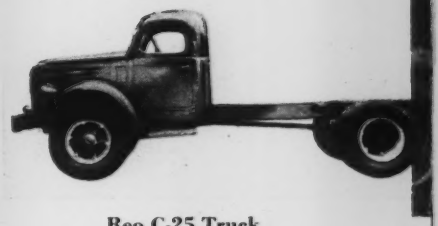
Dodge 1½-ton Truck

International Model W6564 Truck



Euclid LD 30-ton Dump Truck

Willys Jeep Truck



Reo C-25 Truck

Sterling HWS 235 Truck

Athey PD-10 Side-Dump Trailer

mum 15-ton payload. Trailer can dump to either side while in motion.

Reo Motors, Inc., Lansing, Mich.—One of many of Reo trucks for contractors is Continental-powered model C25 with 25,000 to 29,000-lb. rating and 150-in. wheel base. Engine develops 153 hp. at 2,800 rpm.; has 427-cu. in. displacement. C-25 has cold-riveted high-tensile steel frame, reduced deflection-rate springs and four-wheel airbrakes.

International Harvester Co., Chicago, Ill. — Among many International trucks for all hauling purposes are heavy-duty units for on or off highway service. Model KB11F with 37,000 to 48,000-lb. gross vehicle weight rating is 6-wheel dump truck whose 450-cu. in. engine develops 148 hp. at 2,600 rpm. Model W-6564 is 6 x 4 truck with 65,000-lb. gross vehicle weight rating. Powered by 200-hp. Cummins diesel, truck mounts 10-yd. rock-dump body with cab protector.

C. R. Jahn Company, Chicago, Ill.—Eliminating jacks and loading ramps, new Jahn 4-wheel tandem-axle tilt trailer has 8-ton capacity and is balanced so one man can raise or lower platform. Automatic safety lock holds platform in position when loaded or empty. Platform is designed so entire load can be carried on trailer or shifted to transfer greater weight to rear of truck for traction. Draw bar is rubber-mounted to absorb road shock.

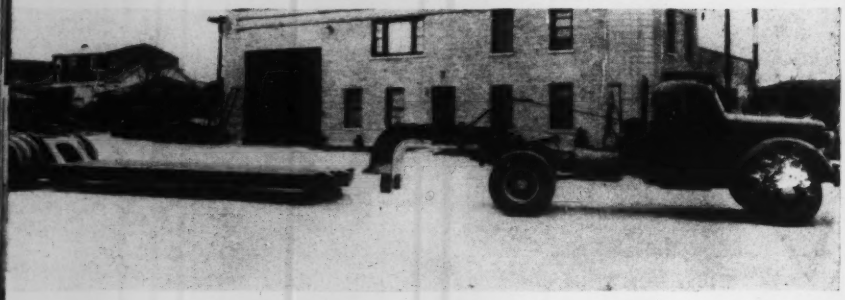
Talbert Construction Equipment Co., Lyons, Ill.—Cable-operated removable gooseneck on Talbert trailer permits low-bed unit to be loaded from front, and gives more trailer bed space as forward bridge ramp is eliminated. Operated by winch on truck-tractor, gooseneck is quickly attached or removed by one man. Trailer tires are same size as truck tires so they generate less heat, last longer and make rig easier to pull.

Fruehauf Trailer Co., Detroit, Mich.—Fruehauf trailers are of all types and include: 8¼- to 20-cu. yd. dump units; pole trailers for long self-supporting loads; platform types; goose neck trailers with capacities up to 100 tons; as well as special types for special jobs. One special unit is 26-ft. trailer whose nose is tilted down during loading so self-propelled machinery goes aboard under own power. Winch on truck-tractor lifts loaded trailer on to the coupling.

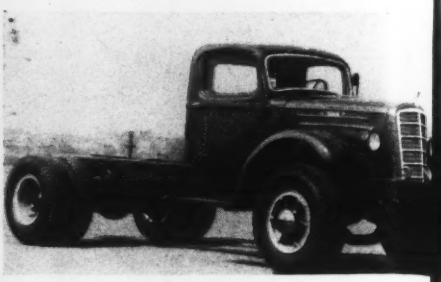
Four Wheel Drive Auto Co., Clintonville, Wis. — Among FWD trucks for contractors are model ZU with rating of 33,000 lb. gross

Jahn Tilt Trailer, 8-ton Capacity

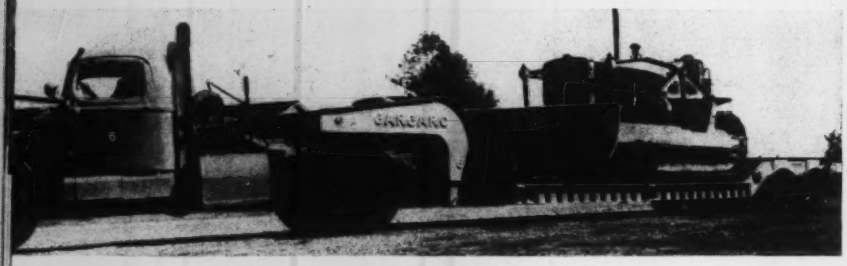
Four Wheel Drive HR Truck



Talbert Removable Gooseneck Trailer



Mack Model EQX, 25,000-lb. Truck



Fruehauf Carryall Trailer

Marmon - Herrington All-Wheel Drive

vehicle weight, model HR with dump body and hoist and two-speed auxiliary transmission for heavy-duty hauling, and model HG with 2½-yd. dump body. This last has underbody road maintenance blade.

Mack Trucks, Inc., New York, N. Y.—With 22½-ton payload capacity and weighing 38,000 lb. empty, new Mack LV end-dumper is powered by 275-hp. supercharged diesel engine. Transmission is duplex type with 8 speeds in two ranges, and final reduction is through planetary gear in hub. Gearless, non-stallable power dividing differential gives exceptional traction on slippery or rough terrain with true differential action and without undue strain on driving parts.

Marmon-Herrington Co., Inc., Indianapolis, Ind.—All-wheel-drive Marmon-Herrington heavy-duty trucks and Ford truck conversions include 4- and 6-wheel models up to 42,000-lb. rating. MH trucks have drop type frame with pick-up over front axle for low center of gravity. Major changes in converting Fords include: installation of front driving axle; addition of transfer gear case or 2-speed auxiliary transmission.

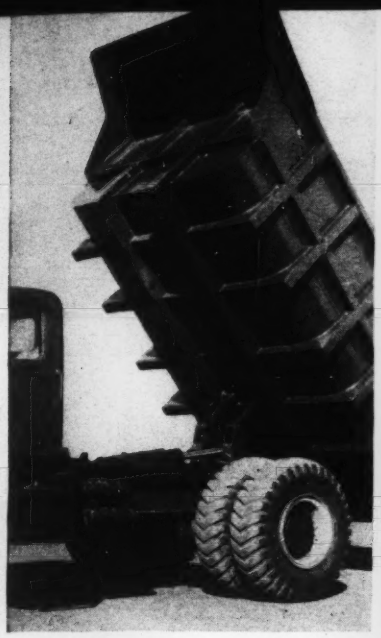
Koehring Co., Milwaukee, Wis.—Popular 6-yd. Koehring Dumptor—heavy-duty shuttling dump unit that travels with equal speed in either direction—now has big brother. Like smaller model, new 12-yd. Dumptor is high-speed, off-road machine, but has controlled gravity dump rather than instantaneous gravity type.

Ford Motor Co., Dearborn, Mich.—Largest ever built by Ford, and especially valuable to contractors, are the new heavy-duty F-7 and F-8 trucks. Powered by a 145-hp. V8 engine developing 255 lb. ft. of torque, the trucks have a maximum gross vehicle rating of 19,000 and 21,500 lb. respectively, with wheelbases of 135, 159 or 195 in. Both models have vacuum power brakes, heavy 9-in. deep frames whose side rails extend forward and are braced by a channel steel front bumper.

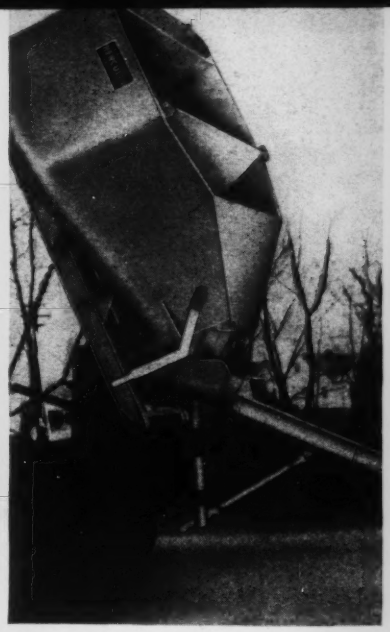
Heil Co., Milwaukee, Wis.—With dump bodies and hoists ranging from small utility type to huge rock-hauling units, Heil covers entire range of contractors' jobs. Typical of heavy-duty type is 20-cu. yd. rock body, 7 ft. wide, with new twin-arm hoist that raises it to 70-deg. dumping angle.

Hercules Steel Products Corp., Galion, Ohio—Designed especially for hauling and placing premium-quality air-entrained concrete, but also capable of handling other materials as well, Aircreter is compact, light-weight, rear-dump body with smooth discharge which eliminates segregation and bleeding. Other Hercules units are model D12 contractor's medium duty dump body, and larger semi-trailer dump body with Type X hydraulic hoist.

Gar Wood Industries, Inc., St. Paul Division, Minneapolis, Minn.—Welded steel St. Paul dump bodies

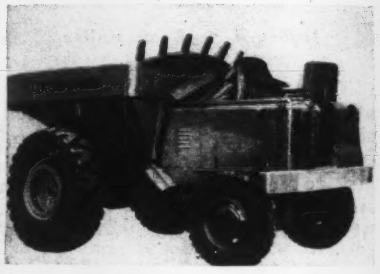


Heil 20-yd. Rock Body



Hercules Aircreter

Gar Wood St. Paul 6-yd. Dump Body



Koehring 6-yd. Dumptor

Ford Series F-7 Truck-Tractor

with matching hoists range from 2- to 12-yd. water level capacity. Hi-dumpers for hauling rock or dirt have scoop ends with no obstructing tailgate, and a 70-deg. dumping angle for quick discharge even of sticky clay. Rock body of ¼-in. steel is welded I-beam braced; floored with 2-in. hardwood liner and ¾-in. wearing plate. Dirt body is 8-gage.

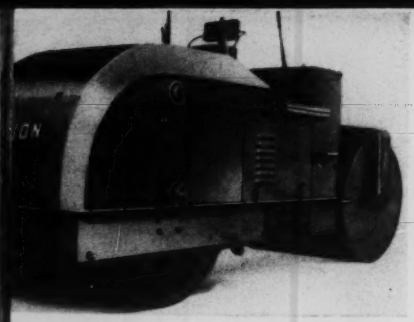
Anthony Co., Streator, Ill.—With one lever control, Anthony hydraulic Lift Gate for all trucks of 1½-ton capacity and up, raises, lowers or holds load at any elevation from ground to truck-bed level. Mechanism automatically locks up to body by safety latches when raised. Tailgate stops automatically at floor level and ground, and may be used conventionally without lift.

6...Compaction Equipment

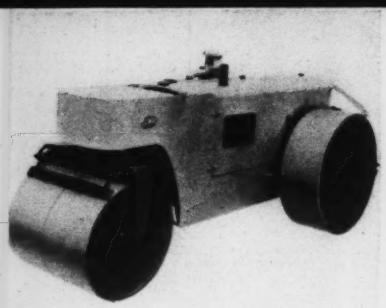
The Galion Iron Works & Mfg. Co., Galion, Ohio — Three-wheel rollers in Galion line are 10- and 12-ton Chiefs and 6-, 7- and 8-ton Warriors. Both models have hydraulic steering and either gas or diesel power. In group of variable-weight tandems are three with similar steering and power and with weights from 5 to 14 tons. Largest is 10-14-ton variable with 60-in. dia. compression roll, 54 in. wide. Galion portable roller with twin rubber-tired rear wheels for steering has built-in hydraulic jacks which lift compression roll off ground for hitching and towing behind truck.

Iowa Manufacturing Co., Cedar Rapids, Iowa — Iowa enters soil compaction field with vibrating compaction machine, on rubber tires, that consolidates material 3 ft. or more below surface. Vibrator, driven by 35-hp. engine and mounted on rig's axle, operates under governor control at 700 to 1,400 cycles per min. to give tamping action that increases plain weight compaction 3 to 10 percent. Larger of two models rides on two 24:00x32-in. tires; weighs 60,000 lb. when loading boxes are filled with iron pigs. Compactors are towed by crawler or wheel tractors at 1 to 2½ mph.

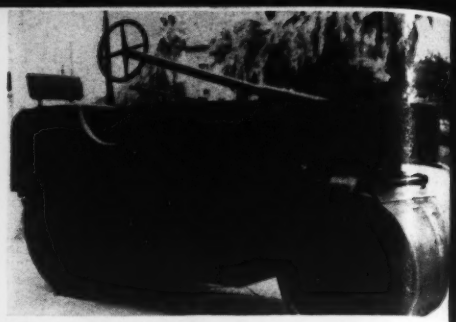
Tampo Manufacturing Co., San Antonio, Tex.—Hollow wheels on Tampo three-wheel 10-12-ton roller can be ballasted for increased weight and pressure. Variable-weight unit has either hydraulic or manual steer, wheel sprinkling system and diesel or gasoline power. For fill compac-



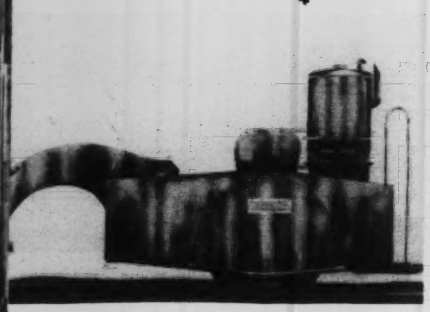
Galion 10-Ton Tandem Roller



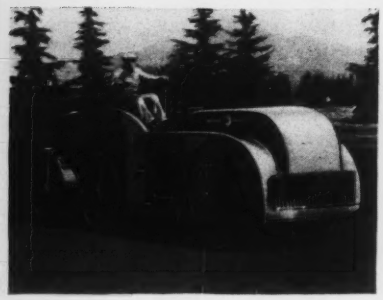
Tampo Variable Weight Roller



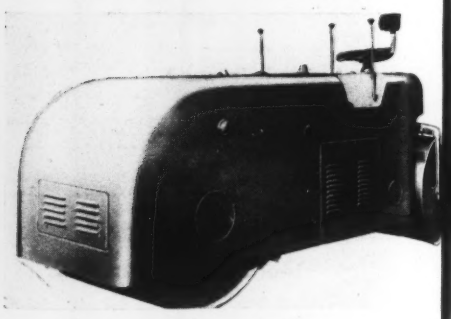
Pierce Bear 2½–3-Ton Tandem



Cedarapids 25,000-lb. Compactor



Buffalo-Springfield Roller



Huber 5- to 8-ton Roller

tion, Tampo's sheepsfoot rollers are supplemented by oscillating pneumatic-tired rollers with 9 or 13 wheels.

Huber Manufacturing Co., Marion, Ohio—Fluid coupling between motor and final drive of Huber 5- to 8-ton tandem roller eliminates shock to machine when rolls are reversed and reduces pavement scuffing. Coupling keeps engine from stalling under heavy load; delivers full torque at all output speeds. For operator comfort, machine has hydraulic steering, controls within easy reach from either side, and movable seat.

Chicago Pneumatic Tool Co., New York, N. Y.—Completely self-contained backfill tamper driven by air-cooled gasoline engine is easy-handling, hard-hitting compactor. Chicago Pneumatic Tamper has magneto ignition; starts with simple downward push of one handle. Unit weighs 82 lb. with 8-in. sq. tamper foot, is 37 in. high.

Lewis Manufacturing Co., San Antonio, Tex.—With ability to roll directly against curb up to 24½ in. high and within 1½ in. of wall or building, Pierce Bear 2½- to 3-ton variable weight tandem roller eliminates expensive hand tamping. V-belt drive between 24½-hp. 4-cylinder Allis-Chalmers gasoline engine and spur gear transmission with multiple disk clutches absorbs shock and peak loads. Similar 6- to 8-ton variable tandem has 33-in. high clearance for rolling next to curb and 2½-in. maximum projection of frame on operator's side.

Buffalo-Springfield Roller Co., Springfield, Ohio — Giving a contractor complete coverage in the smooth-wheel roller field are Buffalo-Springfield's three-wheeled units, two- and three-axle tandems and a trench roller for maintenance and road widening. The three-wheel 10- and 12-ton models are powered by 74-hp., 6-cylinder gasoline engines and have four forward speeds up to 5 mph. The 12- to 18-ton three-axle KX-25 roller has synchronized hydraulic steering to the two guide rolls so there is no scuffing of materials on turns. For rolling vertical curves, the lead guide roll can be unlocked from the operator's platform so it will ride free in a vertical plane.

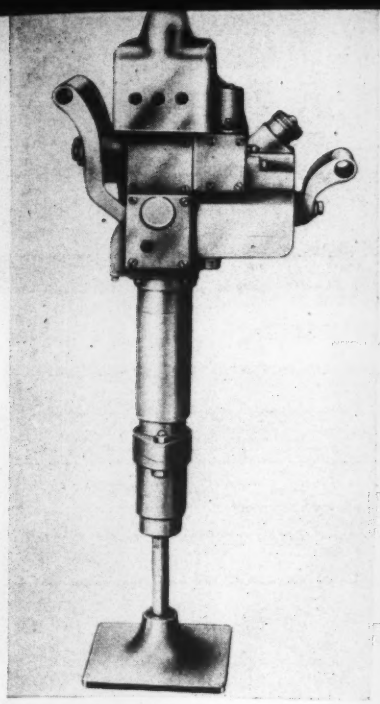
Barco Manufacturing Co., Chicago, Ill.—For soil tamping in places inaccessible to rollers, Barco has entirely new gasoline-driven, hand-operated Rammer. Unit is completely self-contained, weighs 210 lb. and jumps up and down 50 to 60 times per min. to compact soil thoroughly. Machine is guided by operator who merely holds handle, lifts no weight.

Electric Tamper & Equipment Co., Ludington, Mich. — Powered by heavy-duty vibratory motor operated by portable generator, Jackson electric soil compactor achieves 95 percent maximum density to depth of 1 ft. in granular soils in single pass. Compactor weighs 150 lb., propels self at 5 to 6 ft. per min. under guidance of operator, and compacts 10 to 15 sq. ft. per min.

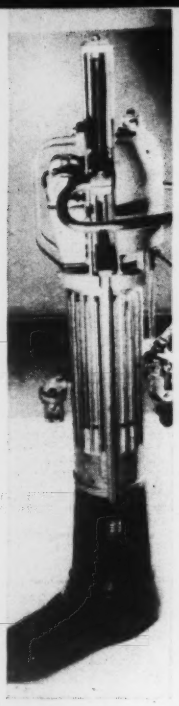
Independent Pneumatic Tool Co., Aurora, Ill. — New Thor Backfill Tampers are streamlined for easier handling. Both 5-in. butt tamper for average work and 6-in. butt heavy-duty tamper for clay and other stiff materials have automatic lubrication, positive-lock butt, positive air seal, new plate valve and enlarged air ports to deliver maximum power under varying line pressure.

Shaw Sales & Service Co., Wheeler Roller Div., Los Angeles, Calif.—Featuring single-lever hydraulic steering, Wheeler Tandem Rollers are in 3- to 5-ton and 5- to 8-ton ranges. Variable-weight units have gasoline or diesel engines with electric starters.

Austin-Western Co., Aurora, Ill.—Both three-wheel rollers and two-axle variable-weight tandems are offered by Austin-Western to cover all rolling jobs. Gasoline or diesel powered, three-wheel Autocrats are available in 10- and 12-ton sizes, while the tandem rollers are in the 5- to 8-ton and 8- to 10½-ton ranges. Steering is hydraulic.



Chicago Pneumatic Gasoline Tamper



Barco Rammer

Jackson Electric Soil Compactor

7...Stabilization and Maintenance

Wausau Iron Works, Inc., Wausau, Wis. — Heavy-duty Wausau plows with alloy steel moldboard have hook-up that distributes shock and thrust to truck frame at several points to prevent damage. Wausau 10-ft. TM4 wing, which has 6-ft. clearance under front and 12-ft. clearance under rear when fully raised, has up and down power on both ends as standard equipment. Units are equipped with front-mounted pump powered by truck engine crankshaft.

Meili-Blumberg Corporation, New Holstein, Wis. — Model 30 Power Maintainer built around modified 31.5-hp. International power unit, is lightweight grader with 5,000-lb. maximum blade pressure. Blade has 12-in. clearance and is hydraulically operated. Optional attachments include leaning front wheels, power broom, snowplow and scarifier. Five forward speeds range from 2.5 to 15.7 mph.

Municipal Supply Co., South Bend, Ind.—Gutter broom, pickup broom and dirt hopper are individually hydraulically controlled on South-Bend Model E Gutter-Snipe street sweeper that cleans paths 6 ft. wide without streaking. Rear wheel steer lets operator follow curb, and seat is offset for better vision. Gutter-Snipe will turn in 19-ft. circle and its gutter broom automatically retracts when obstruction is hit.

J. D. Adams Manufacturing Co., Indianapolis, Ind. — As well as smaller graders, Adams has 100-hp. No. 610 weighing more than 25,000 lb., of which 18,000 lb. is on rear tandem drive wheels. Big motor grader has 8 forward speeds from 2.6 to 25.2 mph., improved power control, and push-button starting on International diesel engine. Latest rig is Adams' rotary snow plow designed for easy attachment to grader and with operating efficiency of truck plows.

T. L. Smith Co., Milwaukee, Wis. — Pre-stretched endless belt on Smith Bulk Cement Spreader accurately deposits specified quantity of material for soil-cement stabilized pavement. Spreader has electrically welded frame and inclosed reversing transmission.

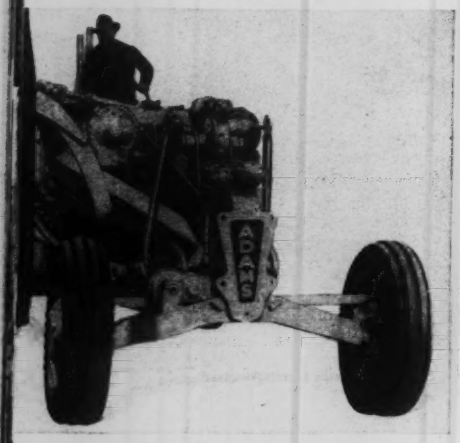
Rome Grader and Machinery Div., Union Fork and Hoe Co., Rome, N. Y.—Powerful 15-ton Rome 404 grader is tandem-drive type with floating rear axle, 8-speed heavy-duty transmission and 474-cu. in. 6-cyl. diesel drive. Blade lift, circle reverse, scarifier, front wheel lean, and steering are hydraulically controlled. Blade has 17-in. lift, 90-deg. bank cutting angle, and 16,650-lb. maximum blade pressure. Newest Rome model is 10-ton 402 with Hercules 6-cyl. diesel and full hydraulic control.

Spears-Wells Machinery Co., Inc., Oakland, Calif. — In a continuous forward motion, Spears-Wells Heater Planer economically removes corrugations and skiddy surfaces of asphaltic or bituminous concrete. Eight oil burners, firing directly down on pavement within inclosed hood, heat surface to semi-plastic state, and shaving block directly behind heating unit removes material to one side. Working speeds are 16 to 17 ft. per min.; travel speed is 12 mph. One man operates 79-hp. machine.

Austin-Western Co., Aurora, Ill. — Unequalled blade reach—as much as 10 ft. 1½ in. beyond the rear tire line—is one of the main features of Austin-Western's new 99-H power grader which also has all-wheel drive, all-wheel steer, precision side shift and controlled traction. The high-lift blade slopes banks up to 90 deg. Austin-Western's lighter 55 grader, powered with gas engine and built with five forward speeds ranging up to 16 mph., is designed to handle maintenance and light grading work. The conveyorless Model 40 motor

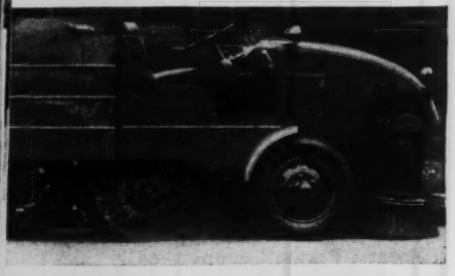
Wausau V-Plow With Wing

Rome 404 Motor Grader

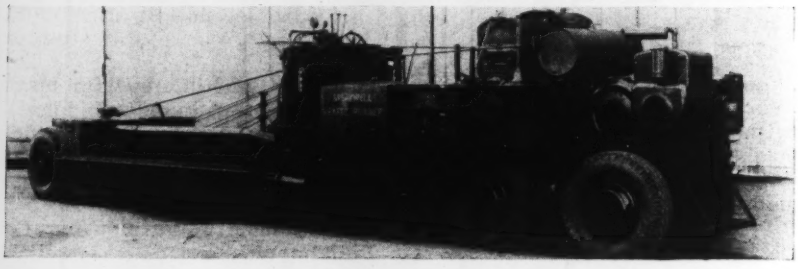


Adams 100-hp. Motor Grader

Smith Bulk Cement Spreader



Gutter Snipe Street Sweeper



Spears-Wells Heater Planer

sweeper, which throws debris directly into its 2-yd. hopper, has a rear broom which doubles as a gate to close the hopper while the load is transported for dumping.

Harnischfeger Corp., Milwaukee, Wis.—P&H Single-Pass Stabilizer is self-powered, self-contained machine for building soil-cement or soil asphalt roads. Diesel crawler-type machine digs and pulverizes in-place materials, blends any admixture, applies liquid, completes final mixing, and spreads to uniform depth—all with accuracy and good speed and under hydraulic control of one operator.

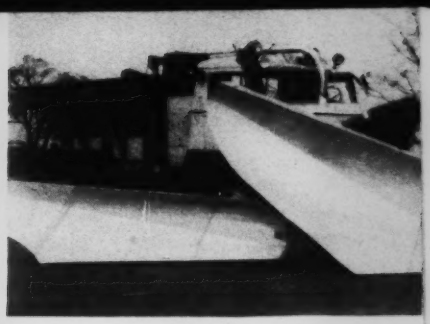
Rosco Manufacturing Co., Minneapolis, Minn.—Hercules 4- or 6-cylinder engines power 650-gpm. Gould pump on new streamlined Rosco Street Flusher. Feature of 1,200 to 2,000-gal. unit is one master directional flow valve which controls one or all nozzles. New two-wheel trailer flusher with 1,000-gal. tank and centrifugal pump direct-connected to air-cooled engine has two flushing nozzles and rear sprinkling nozzles all controlled from tractor driver's seat. Combination flusher-sweeper with 310-gal. tank and 7-ft. broom is designed for towing behind tractor or truck.

Walter Motor Truck Co., Ridgewood, N. Y.—Walter Snow Fighters for all snow conditions range downward from Model AWUS; a 250-hp. Walter truck, 42,000-lb. rating, with power-hydraulic-controlled stainless steel V plows and right and left wings. Lighter models are 240-hp. Model AGRL with center scraper blade, one-way front plow, and right speed wing; and 125-hp. FZMS Snow Fighter with underbody maintenance blade.

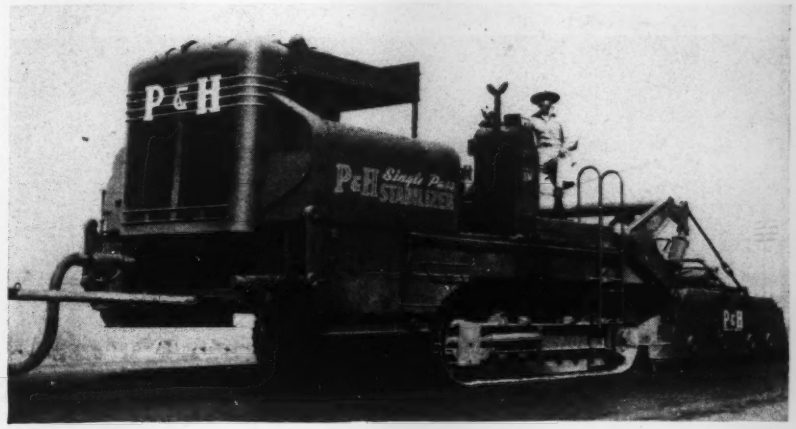
Elgin Corp., New York, N. Y. — With a three wheel design for short turns, Model 30 Elgin street sweeper has a belt-loaded hopper capacity of 2½ cu. yd. and a minimum sweeping width of 7½ ft. Machine is powered by a 113-hp. 6-cylinder motor and has a full floating main broom and fully oscillating digger-type side broom, both hydraulically operated. The Elgin 30 has a 170-gal. water tank and spray bars for sprinkling.

American Road Equipment Company, Omaha, Neb.—In medium-weight range, American No. 8 motor grader is hydraulically operated machine with arch-type welded frame of reinforced 8-in.

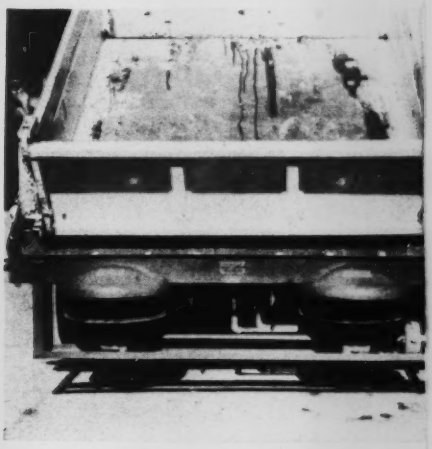
Austin-Western 99-hp. Grader



Walter 240-hp. Snow Fighter

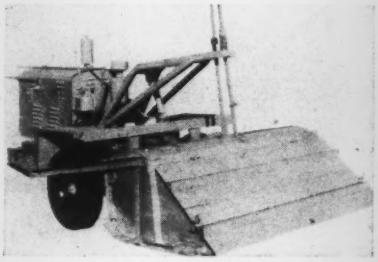


P&H Single-Pass Stabilizer



Hydro-Spreader Road Sander

Rosco 2-wheel Flusher



Seaman Pulvi-Mixer

Elgin Model 30 Sweeper

steel channels, braced with tubular cross members. For American's No. 6 grader, with hydraulic blade and scarifier controls, a new front scoop loader is available.

Hydro Spreader Corp., Waukesha, Wis. — Refinements to Hydro-Spreader hydraulic road sander include automatic gate opening and closing in conjunction with spinners, and quick-coupling hydraulic hose so rig can be changed to seal-coat spreader in 20 min. Machine spreads 8 to 35-ft. width.

Athey Products Corp., Chicago, Ill. —Windrow and snow-loading machine for road maintenance, Athey Force-Feed Loader is self-propelled, with 8 speeds forward from 0.4 mph. working speed to 20 mph. for highway travel. Full-floating, 11-blade feeder gathers material at front and moves it to belt conveyor for discharge over rear to following truck at 5 yd. per min.

Wayne Motor Sweeper Division, Brown-Bevis Company, Los Angeles, Cal. — Pick-up broom guards and shoes of Wayne Motor Sweeper are designed so dirt and refuse cannot pass broom ends to leave ridges of unswept material on street. Pump-fed pressure dust-wetting system atomizes water spray to prevent formation of mud.

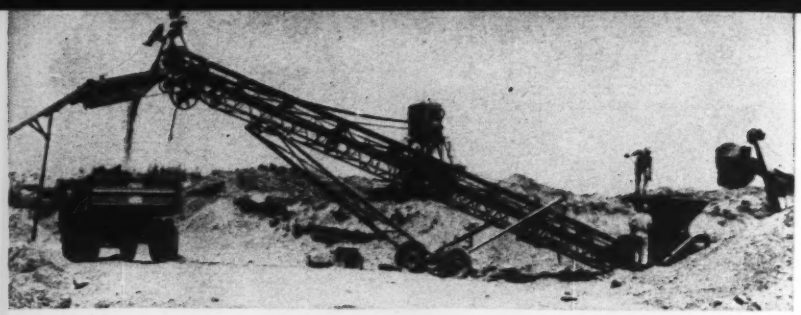
Galion Iron Works & Mfg. Co., Galion, Ohio — Extra heavy-duty tandem drive Galion 116 motor grader with 100 hp. diesel and hydraulic control of blade, scarifier and leaning front wheels, weighs 23,300 lb. Twelve-ft. blade has 360-deg. horizontal and 90-deg. vertical adjustments. Speeds are as low as 1.5 mph. and up to 26 mph. in eighth gear.

Lull Manufacturing Co., Minneapolis, Minn. — Trailer street flusher and sprinkler, with gasoline driven pump, clutch reduction gear and governor, is designed for pulling with industrial wheel tractors. Capacity is 1,000 or 2,000 gal.

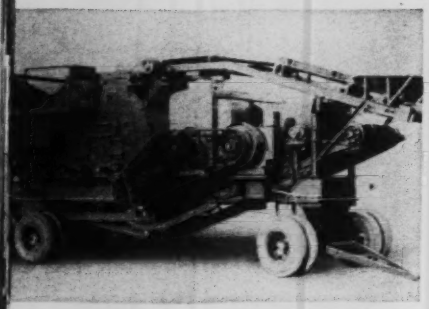
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Now made in two sizes —the 76-hp. Model 3 and 104-hp. Model 4—the Allis-Chalmers AD motor graders feature tubular frames which protect control rods inside, electric brakes, and 30-in. throat clearance for handling bigger windrows. Effective weight is 21,500 lb.

Seaman Motors, Inc., Milwaukee, Wis.—A high-speed rotary imple-

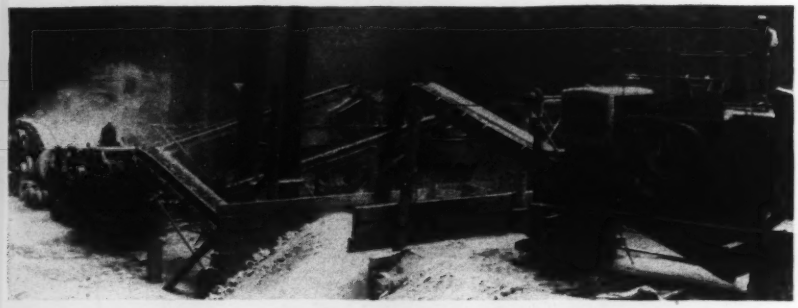
Nordberg Cone Crusher



Pioneer Continuflo Gravel Plant



New Holland Portable Crusher



Cedarapids Unitized Crushing and Screening Plant

ment for mixing all types of soils with all types of binders for road-mix construction and for maintenance and repair of soil-stabilized roads, Seaman mixer gives thorough pulverization of soil and distribution of binder. Newest diesel-powered unit has scarifier, tachometer, pump and spray bar to add oil or water just before mixing.

Austin-Western 101 Crushing Plant

8...Crushers and Screens

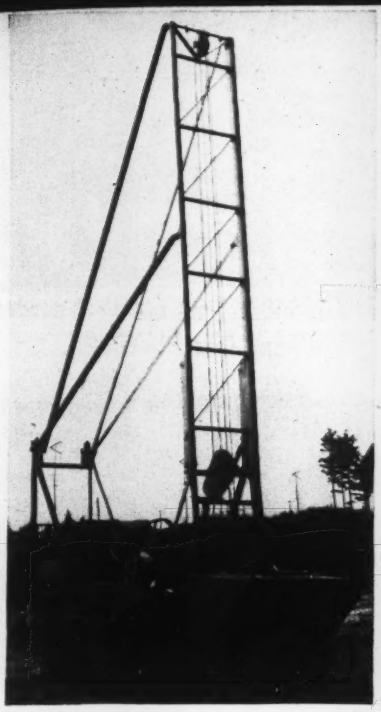
Nordberg Manufacturing Co., Milwaukee, Wis.—Nordberg features Symons crushers ranging from 22-in. intermediate cone crusher with 15 to 45 tons per hr. capacity, to 7-ft. standard cone crusher producing up to 900 tons per hr. Symons vibrating bar grizzlies are recommended for scalping coarse materials; horizontal vibrating screens for extremely accurate sizing. Especially applicable to contractor-type service is 22-in. packaged series of Symons cone crushers. Unit is crusher, complete with motor and drive, on welded steel base and skid for portable or stationary operation. Capacity varies from 20 tons per hr. at $\frac{3}{8}$-in. setting to 60 tons at $1\frac{1}{2}$ in.

Pioneer Engineering Works, Inc., Minneapolis, Minn.—In gravel and quarry field, Pioneer has developed new portable two-unit plant, with primary crusher and necessary screen on one chassis, and secondary crusher and screen on second. Separating feed arrangement of secondary places most of material from primary on to bottom deck of $3\frac{1}{2}$-deck screen, and material from secondary crusher on to top deck. Also new is low-cost Continuflo gravel plant mounted on hydraulic cradle-type truck for ready portability. Unit consists of reciprocating plate feeder and 40 to 50-ft. conveyor with Buzzer screen at end.

Williams Patent Crusher and Pulverizer Co., St. Louis, Mo.—Williams Super-Sluggers are extra heavy-duty hammermill crushers for high tonnage output. No. 445 with feed opening of 45 x 41 in. will take stone from $1\frac{1}{4}$-yd. shovel and reduce it to 2, $1\frac{1}{4}$ or $\frac{3}{4}$ in. in one operation. Ton-per-hour capacities at those settings are, respectively, 200–250, 165–190, 95–120.

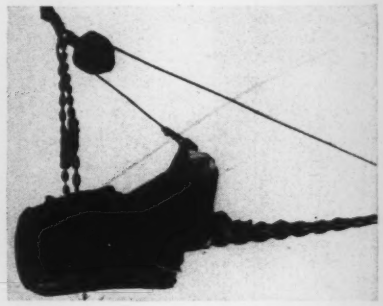
New Holland Manufacturing Co., Mountville, Pa.—Two-unit portable crushing and screening plant has one-man, one-engine operation with individual electric motor drives and simple push-button control from operator's platform. Crusher unit handles primary and secondary crushing in one operation. Screening unit has blending chutes that automatically combine any desired percentage of sized stone to meet any specifications. With only 80 to 150 hp., plant produces up to 200 tons per hr. in one, two or three sizes. Crusher weighs 62,000 lb., screening unit 26,700 lb.

Austin-Western Co., Aurora, Ill.—Largest single unit of Austin-

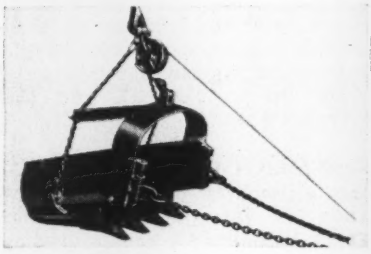


Hydraulically-Steered Scoopmobile

Bell Prime-Mover

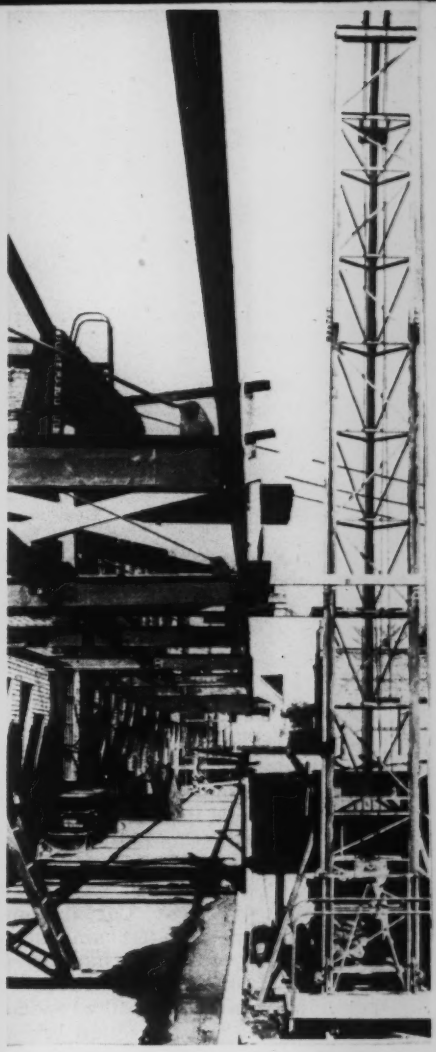


Page 30-cu.yd. Dragline Bucket



Wellman Williams Dragline Bucket

Lull Tilting Tower Universal Loader



American Portable Material Elevator

Western's new line of portable crushing and screening plants is the 101, with capacity from 100 to 200 or more tons per hr. With 10 x 36 jaw crusher, 30 x 18 roll crusher and matched screens and conveyors, the 101 is engineered for low cost tonnage and produces continuous flow of aggregate in controlled sizes.

Iowa Manufacturing Co., Cedar Rapids, Iowa—Cedarapids Unitized plant consists of four basic units—portable primary crusher, scalping unit, secondary crusher, and wet or dry screening unit—that may be used separately or in any combination depending upon material available and end product desired. Each unit can be gasoline, diesel or electric powered, and is mounted on pneumatic-tired truck. Each unit is available in a number of sizes, and all meet highway limitations for weight and dimension.

9...Material Handling

Mixermobile Distributors, Inc., Portland, Ore.—Improved Scoopmobile has hydraulic power steering and reversing reduction gear box for increased maneuvering. Three-wheel unit is gasoline powered, has rear-wheel steer, and has front-mounted tower track on which materials may be raised by variety of attachments. Track height is 12 ft. 4 in., can be increased to 24 ft., and tower is easily folded for moving.

The Wellman Engineering Co., Cleveland, Ohio—Wellman Williams-type welded rolled steel buckets include: 1½-yd. multiple-rope rehandler; ½-yd. general-purpose and ¾-yd. heavy-duty dragline bucket; and ⅜- and ¾-yd. general-purpose clamshells. To increase efficiency of any standard make dragline bucket, Wellman has developed Payload attachment that weighs only about 150 lb. in ¾- and 1-yd. sizes, and which attaches to top of bucket with four bolts. Device is series of longitudinal bars formed into unit which extends from yoke to back of bucket to prevent spillage.

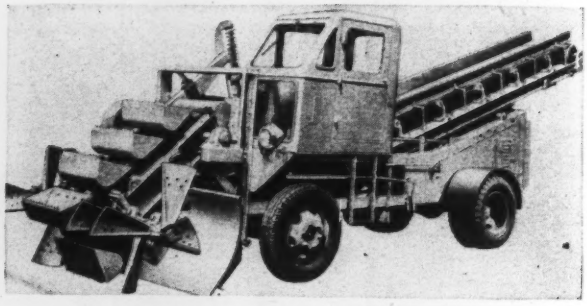
Bell Aircraft Corp., Buffalo, N. Y.—Coming down to earth, Bell Aircraft has entered the materials-handling field with a versatile Prime Mover, a small motorized three-wheel carrier on which is mounted either a 10-cu. ft. bucket or a 30 x 44-in. platform. The 440-lb. machine has a capacity of 1,000 lb. and can climb a 20 percent grade with a full load.

Page Engineering Company, Chicago, Ill.—Besides world's largest dragline bucket—a 30-cu. yd. giant

Haiss Wheel-Mounted 80W Bucket Loader

Yaun 7-cu.ft. Ditching Bucket

Barber-Greene Hopper Car Unloading Team



Pettibone Mulliken Speedloader

for stripping—Page has smaller dragline buckets for more general use. Featured are ½-yd. perforated, 1-yd. slat, and ¾-yd. Page Automatic.

Pettibone Mulliken Corporation, Chicago, Ill.—Self-fed and self-propelled Speedloader handles 5 to 8 cu. yd. of earth or aggregate per min. and snow at 10 to 20 cu. yd. per min. Built around truck-like chassis, rig has front-mounted feeding propellers that move material to chain of elevating buckets, which in turn dump to conveyor belt for rear discharge. Pettibone Mulliken's well-known material handling buckets — shovel, pull shovel, dragline or clamshell—have front, bottom, scoop and teeth of 14 percent manganese steel with tensile strength up to 120,000 psi.

Lull Manufacturing Co., Minneapolis, Minn.—Lull tilting tower loader is telescopic industrial type whose tower leans forward 20 deg. for speedy unloading and 9 deg. to rear for stability while carrying load. Mounted on wheel-type tractor, unit has 2,500-, 4,000-, or 6,000-lb. capacity.

Butler Bin Co., Waukesha, Wis.—Auto-Batch Twinbin is Butler's new cement batching plant that stores 533 bbl. of cement in unit only 30 ft. high. Secret is second-story bin with auxiliary one below in space normally wasted. Conveyor lifts cement to upper bin for live storage, and overflow goes to lower chamber which in turn feeds elevator when required. Automatic twin batcher on platform halfway up structure is fed by upper bin, and loads cement into trucks at rate of two batches every 65 sec. Plant is readily portable, and crews can erect entire plant in 90 min.

Barber-Greene Co., Aurora, Ill.—In addition to their 170-ton per hr. hopper car unloading team—an under-car unloader feeding a portable belt conveyor — Barber-Greene's line of material-handling equipment includes the new Model 545A heavy-duty bucket loader. With a capacity of 3 cu. yd. per min. the machine is mounted on four pneumatic tires, has either two or four wheel drive, and in addition to handling all free-flowing material is easily convertible to snow loader. For general use, Barber-Greene has belt conveyors of standardized design which achieve maximum interchangeability and ease in erection, relocation and dismantling. Along with these is a new heavy-duty portable belt conveyor on pneumatic-tired full-swivelling wheels for loading, stockpiling or for handling wet concrete.

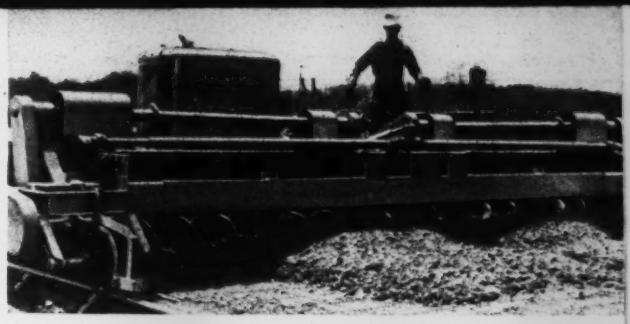
American Hoist & Derrick Co., St. Paul, Minn.—Carrying 2,500 lb. to 40 ft. or higher at 87 ft. per min., American portable material elevator moves anywhere by truck, sets up quickly by own power, and stands without anchors or guys. Unit is designed to take single-drum hoist that swings triangular tower up to vertical, and that operates 6 x 6-ft. skip platform.

Blaw-Knox Co., Pittsburgh, Pa.—For automatic operation, Blaw-Knox is introducing two new weigh-batchers for cement and aggregate. From a portable 200-bbl. cement plant and a three-compartment, 100-ton portable aggregate bin, material batches are automatically weighed out and discharged by push button control.

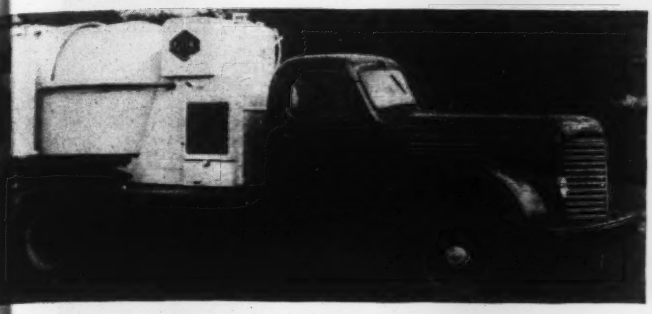
George Haiss Manufacturing Co., Inc., New York, N. Y.—Haiss wheel-mounted bucket loaders handle big yardage at low cost. Model 80W, rated 3 to 5 cu. yd. per min. in rehandling loose materials, has manganese steel feeding propellers that work pile laterally toward bucket, cutting 10-ft. path into pile. Other Haiss products are portable trough conveyor, and belt-type under-car unloader.

Yaun Welding & Dragline Buckets, Inc., Baton Rouge, La.—All-welded Yaun dragline buckets include basket type, shell type, perforated buckets and new ditching types. Of entirely new design, this last digs 600 ft. of sloping ditch per hr. under average conditions. Sizes range from 7 cu. ft. to 3 cu. yd.

Multifoote 34-E Duo-Mix Paver



Jaeger Re-mixing Compacting Concrete Spreader



Smith-Mobile Truck Mixer

Heltzel Dual-Duty 21- and 25-in. Form

10 . . . Concrete Equipment

Foote Company, Inc., Nunda, N. Y. —Multifoote 34-E Duo Mix paver with double-cone, double-compartment drum for folding-mixing action, has fast discharge and fast charging. Mixing cycle is automatically or manually controlled, and twin bottom-dump doors on big 55-cu. ft. discharge bucket may be opened together or individually for controlled placing of concrete. High operator's platform gives good vision of both ends of paver.

Jaeger Machine Company, Columbus, Ohio — Improved re-mixing, compacting concrete spreaders have working-depth range from 3½ in. below to 3 in. above forms, and improved drive. Reversible spreading screws re-mix concrete and work it solidly against subgrade and side-forms into dense non-segregated slabs. New type X diagonal screed finisher has transverse front screed and pivoted rear screed instantly adjustable to best angle.

T. L. Smith Co., Milwaukee, Wis. —One bag 6-S Trailsmith with low center of gravity and balanced construction with excess weight eliminated, and with auto-type leaf springs, tows easily. Portable mixer has automatic high-frequency skip vibrator and multiple V-belt drive. For transit-mix work, Smith has Smith-Mobile truck mixers and agitators.

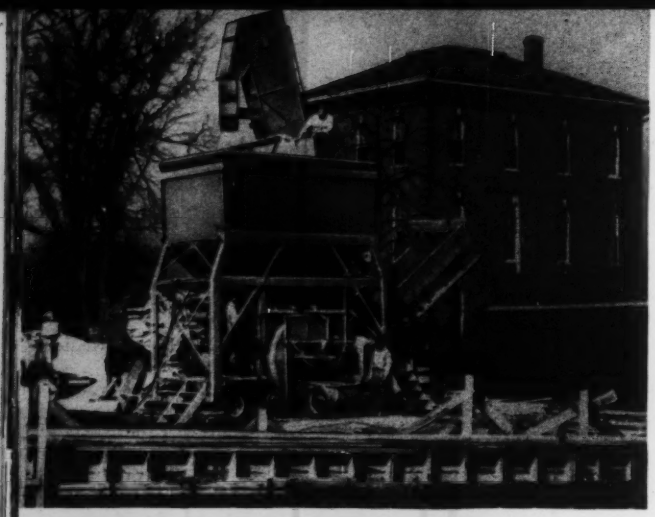
Blaw-Knox Co., Pittsburgh, Pa.— Improved vibratory finisher with 27-hp. engine has selective control that gives 16 combinations of screed and traction speeds through new automotive-transmission. Recently introduced Hi-Boy truck mixers with 2-, 3-, or 4½-cu. yd. capacities have single revolving hopper for both charging and discharging. Newest of Blaw-Knox concrete buckets are single or dual rectangular units with air-operated roller gates and controllable discharge.

Chain Belt Co., Milwaukee, Wis.— Featured in Chain Belt's new and completely streamlined Rex single and double drum pavers is Hydrocycle control which combines timing of batch with timing of complete paving cycle. It automatically starts discharge, starts skip, turns water on and off, closes discharge chute and operates transfer on double drum design. For transit mix operations there is the Rex high-discharge Moto-Mixer that mixes in the discharge direction so the batch is always right up at the opening ready to be dumped in a hurry. For smaller operations Chain Belt makes Rex portable mixers with a "shimmy" skip that speeds loading and a discharge chute that is outside the drum during the mixing cycle.

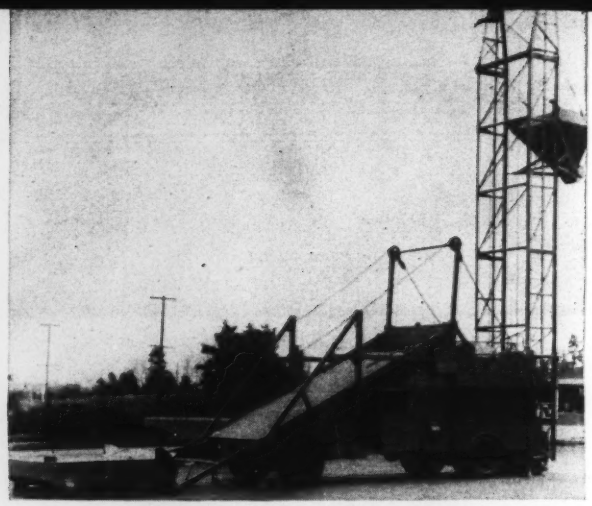
Kwik-Mix Company, Port Washington, Wis. — Tilting discharge chute on Kwik-Mix Dandie portable concrete mixers reaches deep into drum to intercept tumbling concrete at right angle to maintain natural flow-line discharge, and dumps full batch in seven seconds. Non-tilt 6S, 11S and 16S Dandies are now supplemented by new type, non-tilting 3½S.

Heltzel Steel Form & Iron Co., Warren, Ohio — Upturned base flange on Heltzel heavy-duty ¼-in. steel road forms gives additional strength to support today's heavy construction equipment. Special dual-duty forms are made for super-thick airport slabs 21 and 25 in. deep. Heltzel concrete buckets have controlled centerline discharge for filling narrow forms as readily as pouring mass concrete.

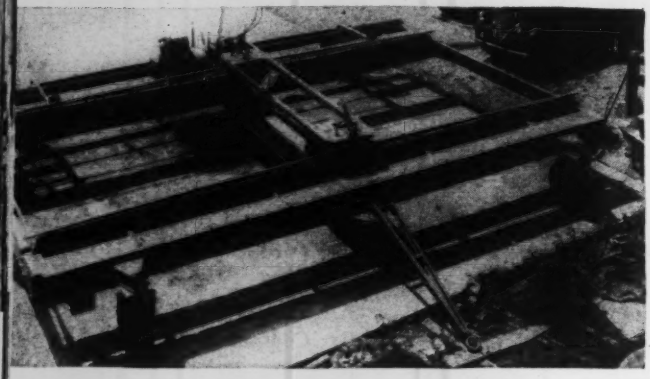
Erie Steel Construction Co., Erie, Pa.—Newly added to 1-yd. Strayer portable concrete plant with 30 to 40-cu. yd. per hr. capacity is boom-suspended concrete bucket that raises each batch to adjustable concrete chute. Feature speeds output, as each batch is immediately freed from plant. Strayer plant has bucket elevator raising aggregate from truck hopper to 20-cu. yd. three-compartment bin,



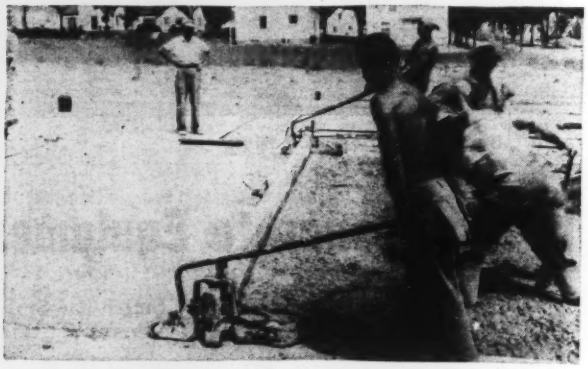
Erie 1-yd. Portable Concrete Plant



Mixermobile Portable Mixer and Hoist



Koehring Hydraulic-Control Longitudinal Finisher



Jackson Electric Vibratory Hand Screed

hydraulic bin gates, weighing Aggremeter, and timed mixing cycle. Plant is on eight-tired chassis.

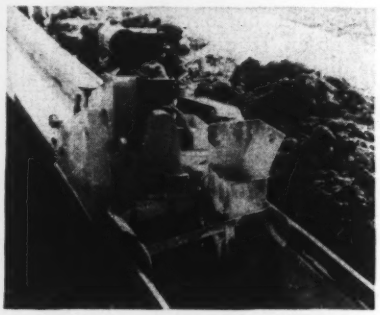
Mixermobile Distributors, Inc., Portland, Ore.—Portable concrete mixing and hoisting plant has 50-cu. yd. per hr. capacity and hoist tower up to 65 ft. high, yet is easily folded for road travel without removal of component parts. Erected by one man and ready for operation in 30 min., Mixermobile has 2-yd. mixer, 1-yd. hoist bucket, and 1½-yd. tower hopper.

Dotmar Industries, Inc., Kalamazoo, Mich. — Mechanical curb and gutter paver that lays 5 lineal ft. per min. and up, is self-propelled with air-cooled gasoline engine, and eliminates face form and division plates. Dotmar paver has flanged wheels riding wood rails that are easily attached to any standard steel form by drilling one hole on top face of each 10-ft. section. Machine paves curves of 100-ft. minimum radius with straight 10-ft. section forms, readily traverses 20-deg. grade.

Electric Tamper & Equipment Co., Ludington, Mich.—Jackson vibratory hand screed, designed for municipal paving, is electric vibrator on wood planks carrying rollers that ride forms or adjacent slab. Plank is cut to pavement section so unit can undercut at side forms, strike off regular or inverted crowns, and work slabs 6-ft. wide and up.

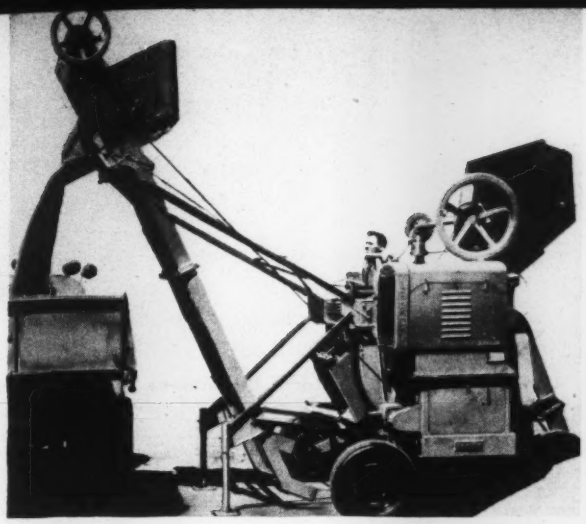
Concrete Transport Mixer Co., St. Louis, Mo.—Designed for mounting on a 2-ton truck, the new Transport mixer with rated capacity of 1¾ cu. yd. (2¼ yd. as agitator) is run by power takeoff. The Transport has two-speed operation for mixing or agitation, and discharges concrete either to the side or to the rear. The 3-yd. Hi-Lo mixer also has power takeoff drive and open-top, stationary mixing drum. Its rear discharge height is 77 in., yet overall charging height is only 115 in. for better clearance under bins.

Koehring Co., Milwaukee, Wis.—By putting a 16-E double-drum,

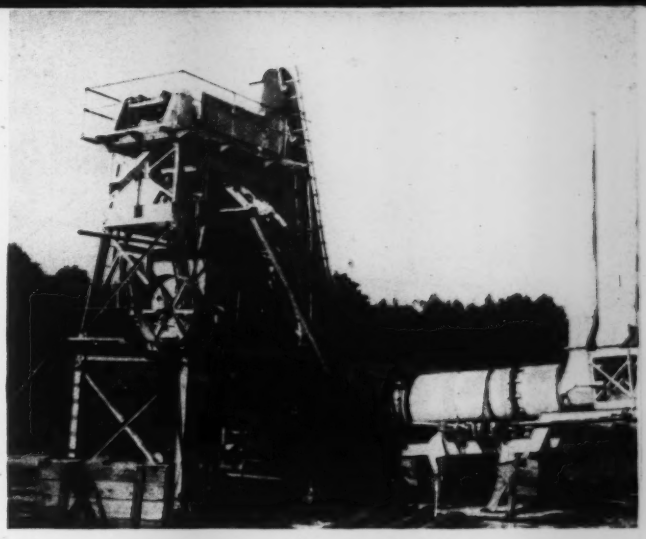


Dotmar Curb and Gutter Paver

elevating-boom paver on wheels, Koehring has developed a maneuverable, flexible rig for building jobs as well as roadbuilding and widening. Model 16-E Twinbatch, rides on two dual-tired wheels at discharge end, single wheels at skip end, and is gasoline or diesel powered with 4 speeds from 1¼ to 10 mph. It is designed to supplement their 34-E Twinbatch paver. Koehring's improved longitudinal finisher, with telescopic width adjustment, incorporates hydraulic screed lift and easier manual crown changes.

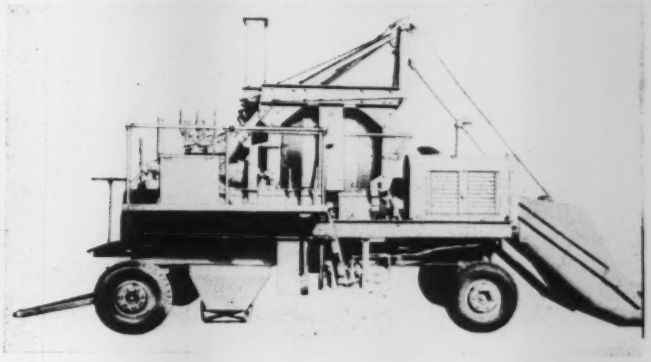


Kwik-Mix Bituminous Mixer

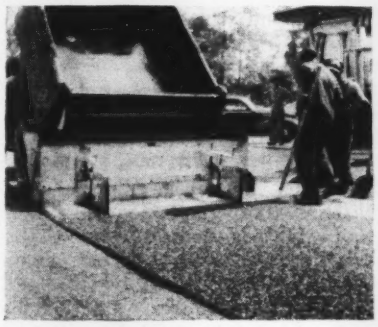


Cedarapids Stack-up Bituminous Plant

Etnyre Blacktopper Distributor



Pettibone Mulliken Portable Asphalt Plant



Miller Spreader

11 . . . Bituminous Equipment

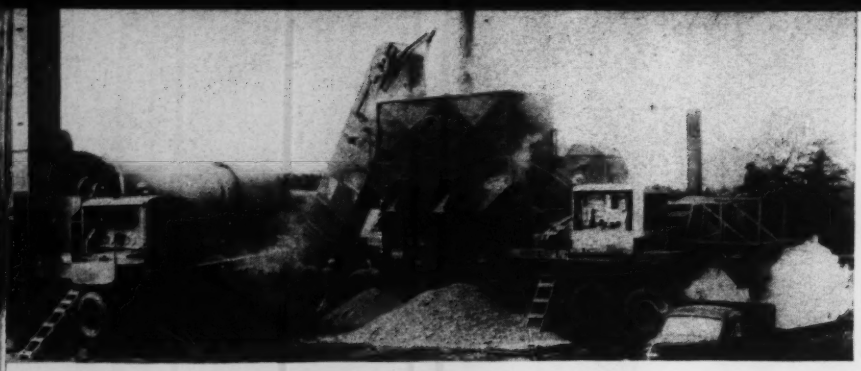
E. D. Etnyre & Co., Oregon, Ill.—In addition to their well-known Blacktopper bituminous distributor, Etnyre has come up with an entirely new full-circulating spray bar with flexible relieving sections at each end that bend forward or back when an obstruction is hit.

Miller Spreader Corp., Youngstown, Ohio—Miller bituminous concrete and aggregate spreader, pulled by dump truck, lays ½- to 8-in. level course at rates up to 1 ton per min. Welded steel spreader attaches to special hitch on truck, and may be carried from job while suspended at rear. In operation, unit rides pair of pneumatic tires ahead of spreader box, and rear screed and finishing plate adjust depth of course.

Kwik-Mix Co., Port Washington, Wis.—New elevating tower on Kwik-Mix 14-cu. ft. portable bituminous mixer hoists material 7¾ or 8¾ ft. for discharge to hauling trucks. Hoist is powered by mixer motor, and controlled by single lever at mixer operator's station.

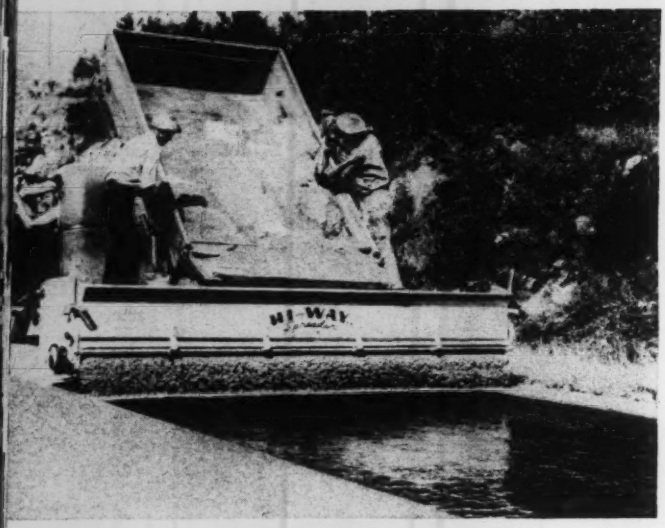
Cleaver-Brooks Co., Milwaukee, Wis.—Streamlined oil fired portable tank car heaters by Cleaver-Brooks are designed to shoot steam through bituminous tank coils at 125-lb. pressure in 20 min. or less from a cold start, and are also valuable as an all-purpose unit for steam cleaning, thawing and heating. For direct heating of bituminous materials in tank cars, Cleaver-Brooks makes a pumping booster that loads directly into distributor, relay truck or returns material to tank car. Also from Cleaver-Brooks is a 150-hp., 150-lb. working pressure oil-fired packaged steam generator designed especially for construction work.

Pettibone Mulliken Corp., Chicago, Ill.—New-type 30- to 40-ton-per-hr. portable batch asphalt plant is mounted on one 4-wheel chassis, is only 24 ft. long, 8 ft. wide and 9¾ ft. high for road travel, yet has insulated revolving drum drier and twin pugmill mixer. Batched aggregate is dumped into receiving skip, loaded into oil-fired drier, transferred to mixer where metered bitumen is added, and discharged to 18-in. by 20-ft. belt conveyor for truck loading. Drier and mixer have 15-cu. ft. capacity. One-man plant

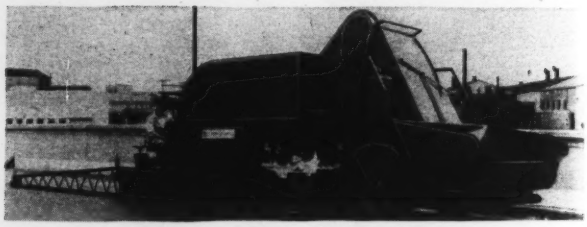


Pioneer Continuflo Hot-Mix Asphalt Plant

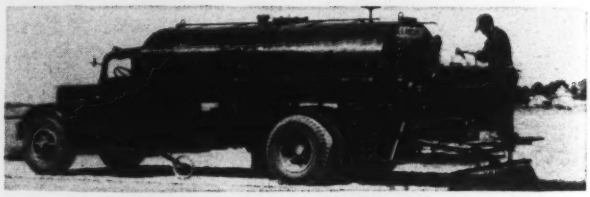
Rosco Bituminous Distributor



Highway Model R Spreader



Hetherington & Berner Moto-Paver



Kinney Bituminous Distributor

weighs 21,000 lb.; is powered by gasoline engine (82 hp. at 1,800 rpm). Mixing process meets all states' specifications for bituminous road construction and for patching or resurfacing.

Iowa Manufacturing Co., Cedar Rapids, Iowa—Newest Cedarapids bituminous mixing plant is 1,000-lb. Model A stack-up batch plant for hot or cold mixes, designed for permanent or semi-permanent installation. Unit has horizontal vibrating screen, dial scales and steam-jacketed twin pugmill. Model FA portable 25-cu.ft. batch plant features centralized air-operated controls for pugmill gate, bitumen bucket, aggregate batcher, bin gates, dust elevator and dust screw.

Rosco Manufacturing Co., Minneapolis, Minn.—Accurate pressure control on Rosco bituminous distributors, 800 gal. and larger, applies bitumen from 0.03 to 3.00 gal. per sq.yd.; automatically compensates for clogging or spray bar length changes. Reverse suction at cut-off prevents nozzle drip.

Hetherington & Berner Inc., Indianapolis, Ind. — Self-contained single-unit Moto-Paver mixes and lays cold-mix and retread paving in continuous operation and leaves surface ready for rolling. Paving width is adjustable from 8½ to 12 ft.; thickness up to 7 in. Four-wheel machine has 2-ft. per min. minimum paving speed and 25-mph. maximum road speed.

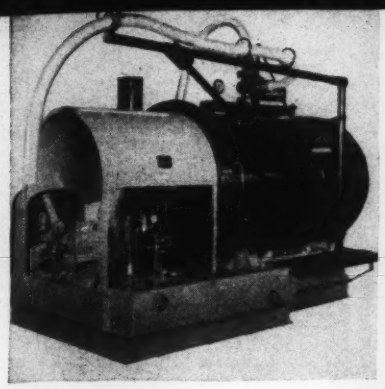
White Manufacturing Co., Elkhart, Ind.—Wheeled, 8-t. per hr. asphalt plant for maintenance work has aggregate drier, pugmill mixer and bituminous heating kettle in one unit. Bucket elevator loads rotating drier drum, then aggregate passes through volumetric measuring hopper into mixer where hot asphalt is added from kettle. Controls are air operated.

Highway Equipment Co., Inc., Cedar Rapids, Iowa—With spiral feed roller and agitator-conveyor for reversible transmission, Model R traction-powered spreader operates with dump truck, either forward or reverse, to spread material for blacktop roads. Adjustable feed gate controls depth of spread, and width can range from 1 ft. to full width of spreader.

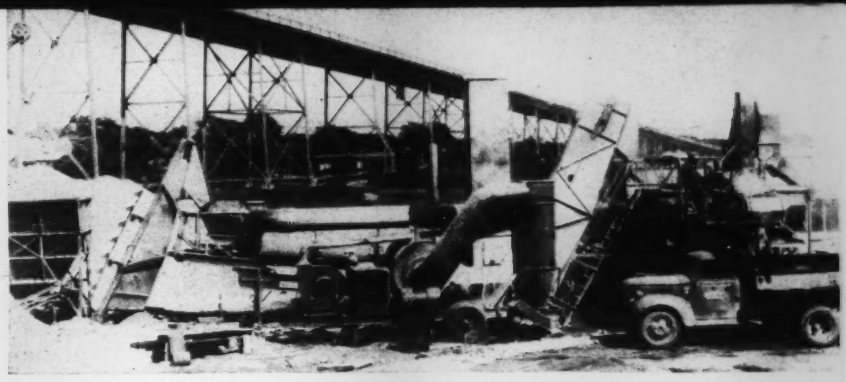
Barber-Greene Co., Aurora, Ill.—Newest of Barber-Greene's bituminous continuous mixing plants is Model 845 Utility—a completely portable, 60-ton-per-hour plant. With a mixer-gradation unit, dryer and dust collector, the Utility handles all types of mixes including those of highest quality with multiple aggregates. For paving, B-G has tamping-leveling finisher that spreads and compacts mix to level course without forms.

Kinney Manufacturing Co., Boston, Mass.—Improved piping in 1,000-gal. Kinney Model A bituminous distributor eliminates cold spots in line. Machine has new solvent circulating system, three-pass heating, circulating spray bar and weight-saving aluminum tank cover over Alfol insulation.

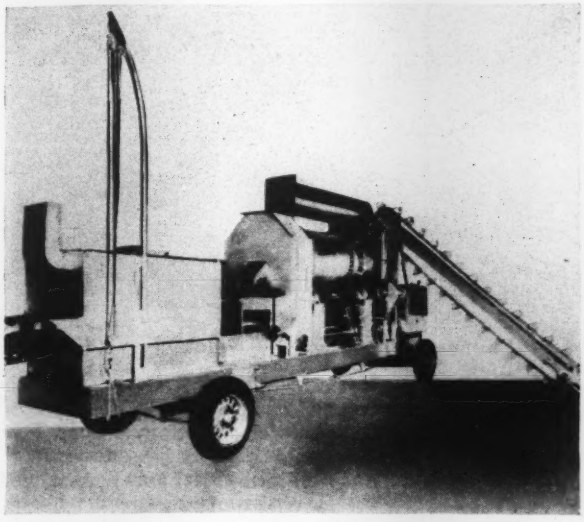
Pioneer Engineering Works, Minneapolis, Minn.—Continuflo hot-mix asphalt plant is complete and highly portable, with two main



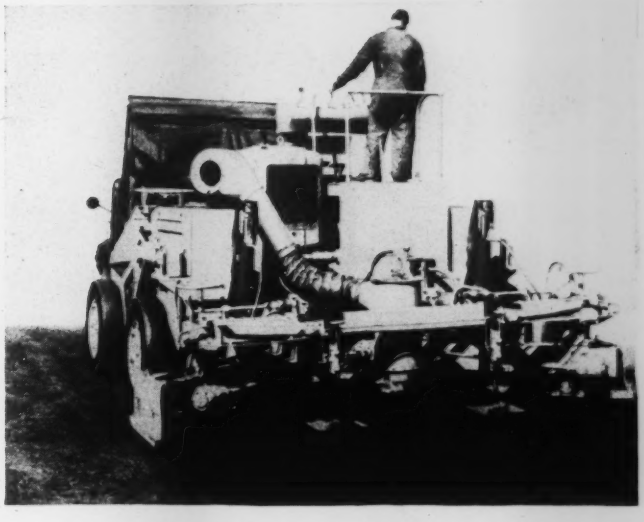
Cleaver-Brooks Bituminous Booster



Barber-Greene 845 Utility Plant



White Portable Asphalt Plant



Jaeger Model BP-5 Bituminous Paver

units and three smaller ones all on pneumatic tires. One chassis carries 90-in.-dia., 125- to 150-ton-per-hr. aggregate drier; second carries gradation screen, sized aggregate bin, proportioning unit, transfer elevator and mixer. Other units are feeder conveyor, multiclone dust collector and hot elevator. Operations are interlocked.

Jaeger Machine Co., Columbus, Ohio—Instantly adjustable between 8- and 12½-ft. widths without insertion of any parts, Jaeger's new BP-5 bituminous paver has high-frequency oscillating compaction and finishing action along with combined wedging and trucking action that works mat to uniform density.

12...Engines and Generators

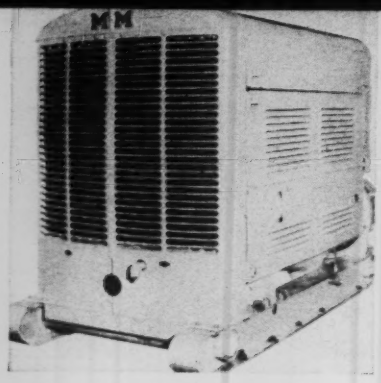
LeRoi Co., Milwaukee, Wis.—Newest of LeRoi's gasoline engines for contractors' equipment is V-type, 8-cylinder H-540. Compact power unit gives wide range of speeds to 1,800 rpm. with 50 to 125 hp. Engine is compact, economical, and designed for heavy-duty operations.

Minneapolis-Moline Power Implement Co., Minneapolis, Minn.—New MM 230-hp., 12-cylinder power unit, model 1210-12A, is designed for fixed or portable installation where dependability on heavy-duty or continuous-duty jobs is required. Feature of smaller MM engines is cylinder heads and blocks cast in pairs for easy removal from crankcase for servicing.

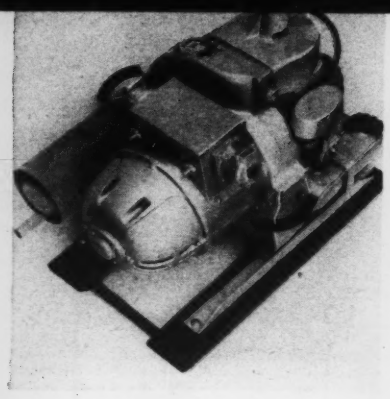
Homelite Corp., Port Chester, N. Y.—Dual-purpose generator—rated 2,500 w., 230 v., 180-cycle, 3-ph. ac.; 2,000 w., 110 v. dc.—operates high-cycle or standard electric tools and floodlights. Powered by 1-cylinder gas engine operating 1¾ hr. per gal. of fuel at full load, entire unit weighs only 129 lb.

Cummins Engine Co., Inc., Columbus, Ind.—Offered as standard or optional power by many manufacturers of construction equipment, Cummins diesel engines in 38 production models range up to 275 hp. in size. Included is a 6-cylinder automotive diesel with special dust protection equipment, rated 200 hp. at 2,100 rpm.; a six cylinder supercharged 275-hp. completely-inclosed power unit; and 6-cylinder, medium speed industrial engine, model LI-600, developing 250 hp. at 1,000 rpm.

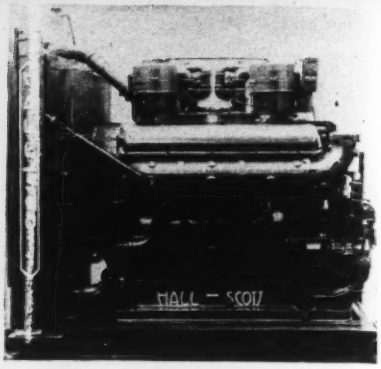
General Motors Corp., Detroit Diesel Engine Division, Detroit, Mich.—Latest of the GM Series 71 2-cycle diesels is the Twin-4—a 236-hp. multiple unit with two 4-cylinder engines mounted together on a common base and geared to a single output shaft. Throttle and clutch controls allow the engines



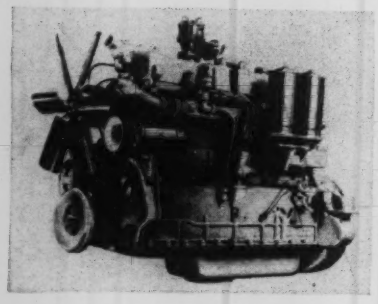
Minneapolis-Moline Power Unit



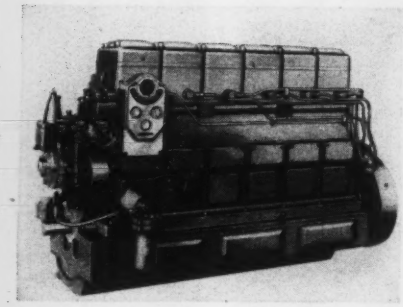
Homelite Dual-Purpose Generator



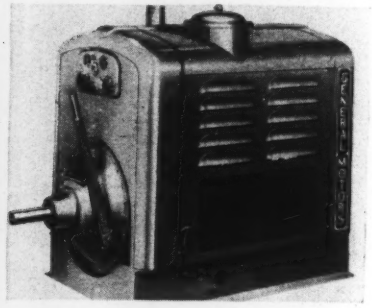
Hall-Scott 12-cyl. V Engine



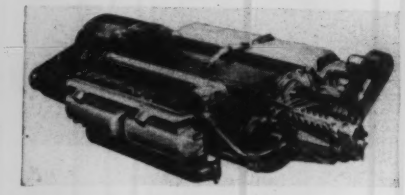
Continental Red Seal Engine



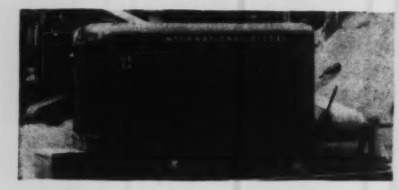
Cummins LI-600 Industrial Engine



General Motors 4-cyl. Diesel



Hercules 260-hp. Pancake Diesel



International 180-hp. VD-24 Diesel

to be operated singly or as a synchronized pair. Transfer gear cases are obtainable with four different ratios, as are four optional power takeoff arrangements. For more power there is 349-hp. Twin-6, a similar multiple diesel engine combination. In addition to multiple and single engines in the Series 71 line, GM has a 120-hp., 4-cylinder packaged power plant complete with power takeoff. As all Series 71 diesels have the same 4¼x5-in. bore and stroke, many basic engine parts are interchangeable among all models regardless of size.

Continental Motors Corp., Detroit, Mich.—With 55 engine models of its own plus 44 of its subsidiaries, Continental nearly covers the entire field of industrial and transportation engines. Models are both liquid and air-cooled, run on gasoline, diesel fuel, natural gas or fuel oil and range from a 1½-hp., 7.1-cu. in. displacement unit to those developing 220-hp. One of the most popular is a 602-cu. in. Red Seal heavy-duty gasoline engine whose six cylinders develop 198 hp. at 2,600 rpm.

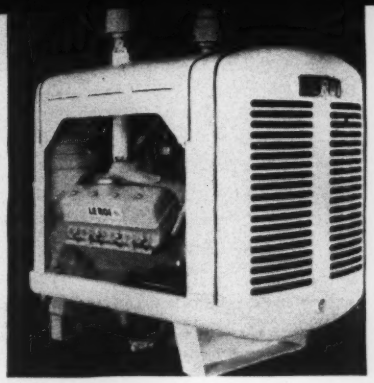
Hall-Scott Motor Division, ACF-Brill Motors Co., Berkeley, Calif.—Overhead camshaft and valve mechanism are features of Hall-Scott 1,090-cu. in. butane or gas model 400 truck engine and 2,180-cu. in. model 2,269-0 industrial engine. Latter is 12-cylinder V-type unit designed for portable equipment so full apparatus will still be within legal limits when mounted on truck or trailer.

Wisconsin Motor Corp., Milwaukee, Wis.—Large fan cast in flywheel of heavy-duty, 4-cycle Wisconsin TE and TF 2-cyl. gasoline engines forces strong blast of air around cylinders and heads for efficient cooling, even at high temperatures. Model TE with 45.9-cu. in. displacement and TF with 53.9 weigh only 255 lb., develop 11.2 and 13.3 hp., respectively, at 2,600 rpm. Wisconsin's heavy-duty air-cooled engines also include 1- and 4-cylinder models.

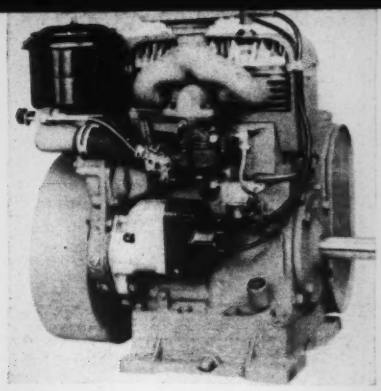
Hercules Motors Corp., Canton, Ohio—Several new solid injection compression ignition, 4-cycle diesels and two high-compression gasoline engines have been added to Hercules high-speed, heavy-duty lines. Included are 600-lb., 4-cylinder diesel in two bore sizes developing 46½ or 57 hp. at 3,000 rpm.; and 750-lb., 93-hp. 6-cylinder model. Three others are horizontal pancake diesels developing 99, 142 and 260 hp. and weighing 900, 1,300 and 2,600 lb. Also added is 8-cylinder, V-type, 4,200-lb. diesel, with three different bores, developing 340, 365 or 400 hp. at 2,100 rpm., and 500-hp. supercharged model.

International Harvester Co., Chicago, Ill.—Power units by International, for running variety of construction machinery, include 22- to 55-hp. carburetor-types and 39- to 180-hp. diesels. Biggest is new UD-24—complete with radiator, fan, clutch and power takeoff—that develops 180-hp. at 1,375 rpm.

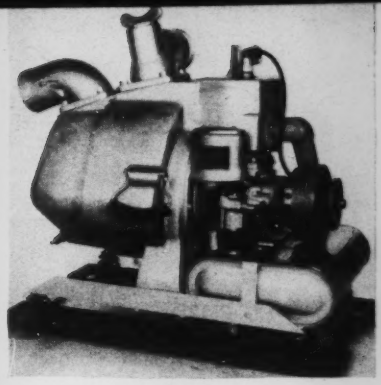
Buda Co., Harvey, Ill.—Engines by Buda range from a 1-cylinder, 5-hp. model up to an 8-cylinder supercharged 410-hp. unit, and include heavy-duty diesels for highway or off-highway equipment. In addition Buda has a complete line of generator sets ranging from 2½ to 125 kw.



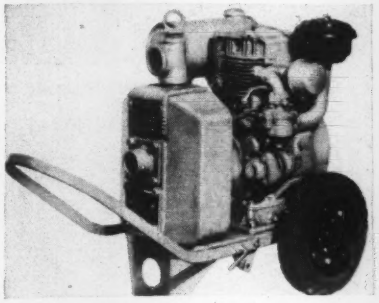
LeRoi H540 V-8 Gasoline Engine



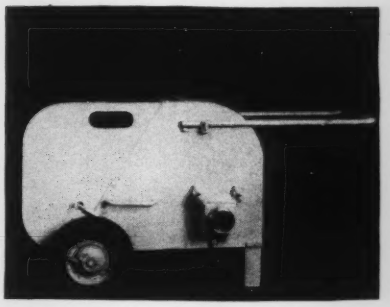
Wisconsin 4-cyle Air Cooled Engine



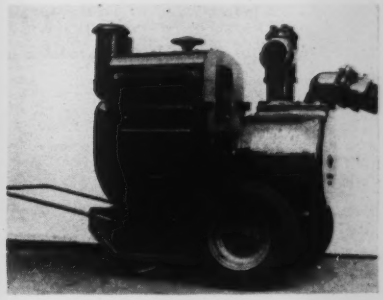
Homelite 3-in. Self-Priming Pump



Rex 10M 2-in. Centrifugal Pump



C. H. & E. 2-in. Diaphragm Pump



Carter Humdinger 30M Centrifugal

13 . . . Pumps

Worthington Pump & Machinery Corp., Holyoke, Mass. — Impellers and renewable impeller wear plates of Worthington Blue Brute pumps are cast of abrasion resisting alloy for long-wear pumping of water containing harsh materials. Pumps are self-priming without re-circulating valves, and range from 3M, 1½-in. to 40M, 4-in.

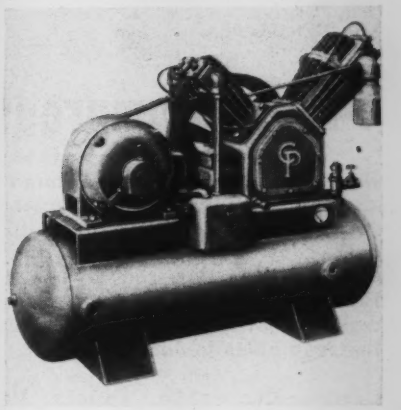
Homelite Corporation, Port Chester, N. Y.—Weighing 95 lb. complete with built-in gasoline engine, Homelite 3-in. Carryall centrifugal pump is rated 15,000 gph. Non-clogging pump is self-priming at all suction lifts to 30 ft., with priming times of 85 and 15 sec. at 25- and 5-ft. suction lifts.

Chain Belt Co., Milwaukee, Wis.—Body of Rex 2-in. centrifugal 10M pump is press-formed of corrosion-resistant metal, easily repaired by welding. Adjustable air peeler compensates for wear to restore original clearance with impeller and maintain priming efficiency at maximum suction lifts. Engine of 220-lb. unit is mounted over wheels for better balance, and locking, movable handle serves as towing tongue or lifting bail.

Gardner-Denver Co., Quincy, Ill.—Air-driven VP-4 sump pump, with closed-type, alloy impeller, has built-in oiler for all moving parts. "Top suction" prevents breaking of pump shaft seal due to water pressure, as oil seal is subjected only to static pressure of immersion depth when pump is idle. Water cannot reach oil in vane-type air motor when pump operates.

C.H.&E. Manufacturing Co., Milwaukee, Wis.—Weighing only 185 lb., new C.H.&E. portable diaphragm pump is compact (29x25x 23 in. overall), inclosed, all-steel unit with 2,500-gph. capacity at 10-ft. lift. Mounted on 2 pneumatic tires, pump has 1½-hp. gasoline engine, rubber swing-type valves and roller bearing shafts. Both suction and discharge connections are tapped inside for 2-in. male coupling and threaded outside for 2½-in. female, for optional use of 2- or 2½-in. hose.

Ralph B. Carter Co., Hackensack, N. J.—Three Humdinger self-priming centrifugal pumps and two Humdinger single diaphragm pumps are offered to contractors by Carter. Lightweight 89-lb., 1½-in. centrifugal reaches full 4,-500 gph. pumping capacity in only 15 sec. Briggs & Stratton 1½-hp. engine drives the midget pump at full speed for 3½ hr. on one gallon of gas. Positive self-priming is also incorporated in 2-in. 10,000-

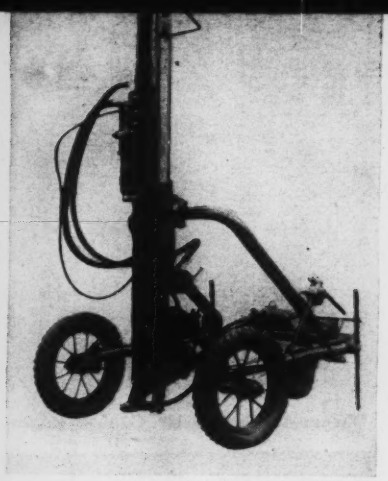


Chicago Pneumatic Compressor

gph. unit with 4½-hp. Wisconsin engine, and in 4-in., 30,000-gph. pump driven by 21.5-hp. 4-cylinder Wisconsin air-cooled engine. Diaphragm pumps are 3- and 4-in. sizes with capacities of 3,000 to 4,500 and 6,000 to 9,000 gph. Diaphragm pumps, as well as two larger centrifugals, are mounted either on steel skids, two steel wheels or pneumatic tires.

Novo Engine Co., Lansing, Mich.—Pronto-Prime centrifugals have self-aligning and adjusting rotating Neoprene seal incased in brass, with external corrosion-resistant spring to maintain correct pressure between hardened seal plates. Seal is oil-lubricated from sight-feed oiler for visible check.

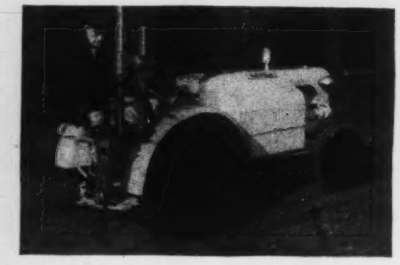
Ingersoll-Rand J-10 Utility Jackhamer



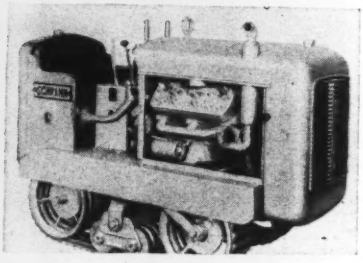
Gardner-Denver Wagon Drill

Homelite Electric Paving Breaker

Davey Construction and Repair Unit



LeRoi Tractor-Compressor-Drill



Schramm 60-cfm. Crawler Compressor

14 . . . Compressors and Drills

Buda Co., Harvey, Ill.—A handy rig for drilling holes for guard rails, poles or piling, is hydraulically controlled model HJB Buda earth drill. Powered by 4-cyl. Buda gasoline engine, machine drills 6- to 42-in. dia. vertical or battered holes to depths of 10 ft.

Gardner-Denver Co., Quincy, Ill.—Lately added to Gardner-Denver line, URM wagon drill with 5-cylinder radial air-motor feed is designed for quick 6-ft. steel changes; carries 3½- or 4-in. bore derrick drill. New paving breaker—63-lb. B67—features safety latch on throttle valve handle to prevent accidental hammer operations while moving tool with live air on line. In compressors, Gardner-Denver has 2-stage portables that are completely water-jacketed to prevent over-heating.

LeRoi Co., Milwaukee, Wis.—LeRoi Tractair—105 cfm. compressor, integral with wheel-type tractor—can now be fitted with interchangeable front-end equipment such as winch, plows, dozer and loader to increase usefulness. With air-fed sinker drill mounted offset at rear, unit becomes Trac-Jac for shallow hole drilling or mud jack work. LeRoi Airmaster compressors now boast 600 cu.ft. model. Like smaller Airmasters, it has automatic throttle, and intercooler design that gives dry, cool, oil-free air. LeRoi-Cleveland contractors' tools include 19-in., 18-lb. clay digger with built-in lubrication system and one-piece buffer of molded rubber bonded to hardened split steel rings.

Chicago Pneumatic Tool Co., New York, N. Y.—Newest of Chicago Pneumatic's compressors is two-stage, electric-driven model, 7½ or 10 hp., for running small hand tools. CP portable units for general contractor service are available in gasoline-driven models from 60- to 315-cfm. actual capacity, and in diesel-driven models, from 105 to 500 cfm. Along with drills for all purposes, CP has complete range of demolition tools from 25- to 80-lb. class.

Schramm Inc., West Chester, Pa.—Crawler-mounted Schramm 60-cfm. compressor travels up to 8 mph. on rubber tracks; negotiates almost any terrain; has hydraulic steering. Combined compressor-engine in unit is V-type 8-cylinder block with 4 cylinders used for power and 4 for compressor. Crawler 60 has drawbar for towing, optional rear power take-off and bulldozer attachments. Schramm's other compressors, wheel- or skid-mounted, include 20-, 35-, 60-, 210- and 315-cfm. units. Tools include handheld rock drills, paving breakers, hammers, clay spades.

Independent Pneumatic Tool Co., Aurora, Ill.—Just added to Thor line is 70-lb. paving breaker for operation in pairs from one 105-cfm. compressor. Unit is 28 in. over-all without tools; handles usual 1⅛- or 1¼x6-in. shank accessories as well as sheeting driver and special front head for driving spikes up to 12 in. long. Thor also has new wagon drill.

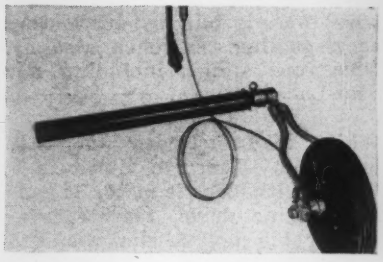
Ingersoll-Rand Co., Phillipsburg, N. J.—From 21-ton self-propelled Quarrymaster drill—which carries own 500-cu.ft. compressor, drills 6-in. holes to 70-ft. depth and has piston-type drill with automatic rotation, controlled feed and continuous dry hole cleaning—to 14-lb. Utility Jackhamer, Ingersoll-Rand's line covers wide range. Included is lightweight Wagonjack that has stability of

Motorola 2-way Radio-telephone

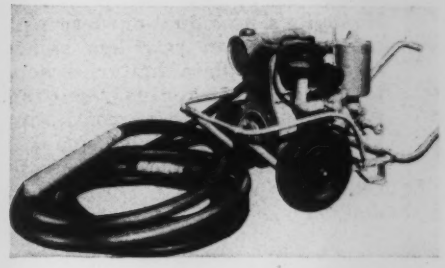
Mall Gasoline Chain Saw

Flex-Plane Spray-Cure Machine

White Electric Flexible-Shaft Vibrator



Roscodometer Lineal Measurer



Jackson Hydraulic Vibrator

wagon drill; portability of jackhammer. Rig mounts J-50 Jackhammer or DA-30 drifter, has air-driven chain feed, power-lift frame, and one-man operation. Feature of new J-30 lightweight Jackhammer is 3-in-1 backhead so drill is easily converted to wet, dry, or blower type. In compressors, I-R's portable Pac-Air and Mobil-Air units range from 37½ to 500 cfm. Drill bits include Carset Jackbit with tungsten carbide cutting edges.

Davey Compressor Co., Kent, Ohio —Mobile construction and repair unit on Dodge four-wheel drive Power-Wagon consists of Model 105 Davey Auto-Air compressor and combination generator producing 300-amp. welding current and 8,000 w. ac. Compressor and generator are driven direct from truck engine through Davey heavy-duty power take-off. Two new portable compressors in Air-Chief line are gasoline-powered 105 and diesel driven 315.

Homelite Corp., Port Chester, N. Y. —Handy for small or isolated jobs, new Homelite electric paving breaker is operated by 125-lb. dual-purpose companion generator. High-cycle breaker is about same size and weight as normal air-operated ones.

15 . . . Miscellaneous Equipment

Heltzel Steel Form & Iron Co., Warren, Ohio—Flex-Plane machine for automatic spray-curing of slabs rides on forms, is self-propelled and has automatic spray-nozzle travel. Machine can also be equipped to mechanically broom or belt slab and install permanent traffic line. Also new is Heltzel's Enamelite poured joint filler, which is cold applied and machine-installed in plastic concrete, yet meets bond and extension requirements of Federal specification ssf-336 for hot-poured type.

Maginniss Power Tool Co., Mansfield, Ohio—Hi-Lectric vibrator and tools all operate on 180-cycle current, furnished by new 120-v., 2-kw. portable generator. Vibrator has motor inside 2⅜-in. dia. head for 9,500-rpm. direct eccentric drive. Tools are lightweight concrete surfacer and form sander, and 8-in. circular saw.

Anchor Coupling Co., Inc., Libertyville, Ill.—For the contractor, Anchor features factory-fabricated hydraulic hose assemblies for high, medium and low pressures. Those for high pressures are two or three wire braid hose, while for medium and low pressures they are one wire braid or reinforced fabric. Also featured are emergency repair and field service clamp type couplings for high pressure hydraulic hose, and reusable couplings for medium and low pressures.

Construction Machinery Companies, Waterloo, Iowa — Improved concrete mixers and self-priming pumps by CMC are now joined by Jetcrete gun for pneumatically applying concrete, and new electric radial saw unit. For extreme portability, saw, saw-table and gasoline-driven generator are mounted on 2-wheel, rubber-tired trailer.

Electric Tamper & Equipment Co., Ludington, Mich.—Attached to finisher or spreader, Jackson electric vibratory paving tube gives uniform compaction through slab and makes other vibration unnecessary. Tube is hydraulically controlled by finisher or spreader operator; is adjustable from 10 to 25 ft. Designed for use without

tube are new side form vibrators, also controlled by machine operator. Vibrations from electric units on machine are transmitted to simple loops of steel tubing lowered into concrete alongside each form. Other Jackson vibrators include flexible-shaft gas and electric-driven units, hydraulic models, puddler or platform vibrators, heavy-duty mass concrete units and external vibrators for forms and bins.

Homelite Corp., Port Chester, N. Y.—High-cycle electric chain saw weighs only 27 lb., but with open-end 28-in. cutter bar can fell 3-ft. trees. Designed for use with Homelite's new dual-purpose generator, one-man saw has spiked steel bumper plate that grips wood to act as pivot for easy cutting. Also new is 2,000-cfm. ventilating blower weighing 65 lb. complete with built-in gasoline engine. Carryable unit takes 8-in. duct; doubles as exhaust fan or blower.

Wire Reinforcement Institute, Washington, D. C.—Newly published Design Manual for Airport Pavements is featured by Wire Reinforcement Institute who stress use of welded wire fabric. Manual shows reinforced concrete pavement designs for runways, taxiways and aprons.

Blackhawk Mfg. Co., Milwaukee, Wis.—Specializing in high-pressure oil hydraulics, Blackhawk has pumps, rams and valves for operation and control of construction equipment, as well as hydraulic jacks and wrenches for contractors' use. Jacks have capacities up to 100 tons and operate in any position.

Herman Nelson Corp., Moline, Ill.—Featured by Nelson are two new portable heaters, fired by fuel oil rather than gasoline and with electric motor drive, in utility and deluxe models. Latter is streamlined unit with fully-automatic operation and full heating capacity characteristics of larger Nelson heaters.

Ingersoll-Rand Co., Phillipsburg, N. J.—Reversible electric impact tool operates like normal ¼-in. hand drill until predetermined resistance is met, then delivers 1,900 rotary blows per min. to increase turning force. Torque-less machine can't be stalled, operates at 115 v., weighs 6½ lb. Also added to I-R line is midget air-powered Airlite generator that supplies current for two 75-watt bulbs anywhere that air is available.

Jeffrey Manufacturing Co., Columbus, Ohio—Prominent among Jeffrey's transmission items are steel thimble roller chains for propelling and final drives, crowds and retracts. Others are tempered steel carved sprockets. For material handling, Jeffrey has belt idlers; for crushing, a 54 x 70-in. pulverizer.

A. Leschen & Sons Rope Co., St. Louis, Mo.—Hercules Red-Strand wire rope, is tough, long lasting, easy-spooling. Leschen also has wire rope slings, including new Flat-Laced type.

White Manufacturing Co., Elkhart, Ind.—Concrete vibrators by White, with electric motor or gasoline engine drive, feature interchangeable flexible shafts and vibrator heads. Tip and lower part of head are hardfaced. Other White items are kerosene torches with intense heat for thawing, melting, pre-heating or burning.

Texas Co., New York, N. Y.—Texaco asphaltic products, refined from selected crudes, include a material exactly suited to every street construction and maintenance need. Available are two new booklets: one on plant-mix paving, other on asphaltic construction with material applied by pressure distributor.

Motorola Inc., Chicago, Ill.—With 2-way radio, Motorola offers contractors quick communication between isolated crews or machine operators to cut stand-by time. Newest unit is FM Handie-Talkie portable weighing 18½ lb. It has compact crystal-controlled transmitter and receiver, over 2-mi. range, and operates in 25–44 mc. band.

Union Wire Rope Corp., Kansas City, Mo. — Union-Formed wire rope is preformed for kink-resistance, flexibility and resistance to twist. Worn rope handles safely as broken outer wires don't protrude.

Mall Tool Co., Chicago, Ill.—To help roadbuilders, Mall has electric saws and drills for formbuilding; chain saws for clearing; vibrators and surfacers for concrete work. Vibrators are pneumatic, electric or gasoline-engine powered. With last, attachments are available for variety of tool operations using same 1½-hp. gasoline engine as power.

C.I.T. Corp., New York, N. Y.—Financing purchases and sales of all types of construction equipment, C.I.T. is one of contractors' most valuable material suppliers. Firm provides funds for contractors to complete machinery purchases, and to distributors to turn installment sales into cash transactions as well.

Union Metal Manufacturing Co., Canton, Ohio—Featured by Union are tapered Monotubes for cast-in-place concrete piles. Tubes are fluted and tapered for easy driving; are quickly extensible on job; are lightweight yet need no driving mandrel.

Rosco Manufacturing Co., Minneapolis, Minn.—Roscodometer accurately measures lineal distances in feet up to 100,000 ft. for preliminary or mapping surveys. Fifth wheel attached to underframe of car or truck adds or subtracts distances and transmits them to recording dial in car.

Vulcan Iron Works, Chicago, Ill.—Vulcan's pile extractor, with only one moving part, requires no assembly to put it in service, nor any adjustments, and can't get out of order. Vulcan also makes single- and differential-acting hammers for driving all types of piles.

Morse Chain Co., Detroit, Mich.—Morse silent chains and sprockets are now made to industry standards for full interchangeability. Other new Morse products are small-diameter friction clutches with capacities from 0.5 to 1.7 hp. per 100 rpm., and full series of sprag-construction over-running clutches.

Timken Roller Bearing Co., Canton, Ohio—Timken tapered roller bearings now have 25-percent increase in load capacity ratings due to improvements in alloy steel, metallurgical control and surface finishes. Timken also features drill steel, and rock bits with one-piece solid shoulder.

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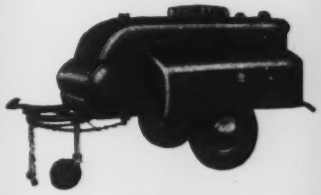
IT PAYS TO USE SCHRAMM!

VERSATILE . . . because Schramm can furnish air for any compressed air job in your work; and versatile because there is a size and model Schramm to fit your individual needs!

EASY TO OPERATE . . . merely by pushing a button to start, and compact and lightweight enabling you to move the portable units wherever you like! Meanwhile, the stationary units take up very little room, are vibrationless and no trouble!

ECONOMICAL . . . because Schramm can do *all* your compressed air jobs quickly and efficiently. Features that assure economy include 100% water cooled, forced feed lubrication, and mechanical intake valve.

Your field has found that Schramm Air Compressors well fit its needs. And has specified Schramm everywhere . . . North, East, South and West. Write today for full data.



PORTABLE

STATIONARY

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

TOOLS *for the* JOB

Schramm Inc. also has a complete line of Pneumatic Tools to offer and recommend for operation by their Compressors.

These include Rock Drills, Paving Breakers, Trench Diggers, Clay Spades, Backfill Tampers, Tie Tampers, Sheeting Drivers, Demolition Tools, Chain and Circular Saws.

Write for bulletins and prices.

BE SURE TO VISIT THE SCHRAMM DISPLAY AT BOOTH 3201-3212 THE AMERICAN ROAD BUILDERS' SHOW, JULY 16TH TO 24TH, CHICAGO, ILL.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents
August Materials and Labor Prices will appear in the August 5, 1948 issue

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash. dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block	READY MIXED CONCRETE 1:2:4, over 50 c.y., del.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in	¾ in.	Sand grav.	Lt.wgt.Agg.
Atlanta	$4.03	$3.26	$2.98	$2.00	$2.00	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	$0.1725	$11.00
Baltimore	3.97	3.20	2.92	2.20*ff*	2.20*ff*	1.80*ff*	2.40*ff*	2.50*fft*	2.35*ff*	2.35*ff*	.15	.15*w*	9.20
Birmingham	3.65	2.88	....	2.06	2.06	1.66	2.50	2.50	1.00	1.20	.15	.15	7.45
Boston	4.47	3.70	3.42	1.50‡*t*	1.50‡*t*	1.40‡*t*	1.25‡*t*	1.35‡*t*	....	....	.186	.195*w*	10.50*m*
Chicago	3.65	2.88	2.60	2.75‡*d*	2.75‡*d*	3.20‡*d*	2.75‡*d*	2.75‡*d*	2.00‡	2.00‡	.20	.20*x*	....
Cincinnati	3.90	3.13	2.85	1.85‡*pp*	1.85‡*pp*	1.75‡*pp*	2.95‡*bb*	2.95‡*bb*	2.20	2.20	.19	.195	10.05*hh*
Cleveland	3.82	3.05	2.72	1.90*llg*	1.65*llg*	1.45*ll*	3.45‡*h*	3.45‡*h*	2.60	2.60	....	.21	11.20*qq*
Dallas	3.57	2.80	2.52	2.00	2.15	1.75	2.00	2.10	....	....	.0775*p*	.255	8.85
Denver	.....	3.32	3.02	1.85	2.00	1.15	....	....	....	....	.20	.2175*w*	9.65
Detroit	3.67	2.90	2.62	3.00‡	3.00‡	2.75‡	2.75‡	2.75‡	2.75‡	2.75‡	.17	.18*w*	9.15*kk*
Kansas City	3.68	2.88	2.63	2.05/2.10‡	2.05/2.10‡	1.50/1.80‡	1.45*q*	1.45*q*	....	....	.16*wf*	.175*ay*	9.85*n*
Los Angeles	....	3.60*b*	3.20*b*	1.92‡	2.02‡	1.72‡*nn*	1.92‡	1.92‡	....	....	.085*oo*	....	9.96*m*
Minneapolis	3.95*dd*	3.18*dd*	2.90*dd*	2.10*h*‡*j*	2.10*h*‡*j*	1.20*h*‡*j*	2.20*h*‡*j*	2.20*h*‡*j*	....	....	.21*cco*	....	10.30*jkk*
Montreal	....	2.39*r*	2.24*r*	....	1.85*bbs*	....	1.55*cs*	1.75*cs*	....	....	.22	.2265*w*	8.65*ls*
New Orleans	3.63	2.86	2.58	2.32	2.32	1.82	....	....	.90	1.15	.23	....	10.65
New York	....	4.00‡	....	2.00*de*	2.00*de*	1.45*de*	2.00*ds*	2.00*ds*	....	....	.18*ii*	.18*wccii*	10.50*k*
Philadelphia	3.72‡	2.95‡	2.67‡	2.30‡	2.40‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.22/.25	.22/.25*w*	9.85
Pittsburgh	3.79	3.02	2.74	2.05‡	2.05‡	2.35‡	2.50‡	2.50‡	2.05	2.05	.22*z*	.22*z*	10.85
St. Louis	3.80*o*	3.03*o*	2.75*o*	2.40‡*oh*	2.40‡*oh*	2.00/2.40‡*oh*	1.50*c*	1.50*c*	1.10	1.15	.20	.23*yo*	10.40
San Francisco	.....	3.38	2.98	1.84	1.84	1.94	1.94	....	....	....	....	.25*y*	10.75*u*
Seattle	.....	3.45*mm*	2.95*mm*	2.75‡*od*	2.75‡*od*	2.75‡*od*	3.50‡*od*	3.50‡*od*	....	....	.22*o*	....	9.75*o*

‡ Delivered. *a* F.o.b. truck at plant. *b* 10c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks, Man. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* ½ in. *j* 5% discount for cash. *k* 5 cu. yds. or over, del. Man. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* Sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *v* F.o.b. scow, Hudson River, N. Y. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7–9 mi. zone. *bb* Under 5 tons. *cc* 8 x 8 x 18 in., also. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant, called for. *mm* 10¢ per bbl. off cash 10 days. *nn* Concrete sand *oo* 4x8x12 std. wgt. *pp* 5 tons or more. *Prices include dealer's commission except where indicated to the contrary.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL‡‡

Charge for bags not included. For cloth bags, add $1.05 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 28c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.10	$2.10	Ironton, Ohio	$2.15*	$2.15*	Universal, Pa.	$2.20	$2.20
Hannibal, Mo.	2.20	2.20	Northampton, Pa.	2.15	2.15	Waco, Tex. (Plus 9c. tax in Tex.)	1.95	1.95
Independence, Kans.	2.20	2.20	Richard City, Tenn.	2.20	2.20	Montreal City (Discount 10c. per bbl. 20 days)	2.08	2.08
			Steelton, Minn.	2.30	2.30			

* Destination price base effective Dec. 22, 1947

‡‡ Latest data available as this issue goes to press. Cement prices now under study due to Supreme Court decision on multiple basing point pricing system. Any resulting price changes will be reported when available.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	.....	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore	150.00‡	52.70‡	.....	$23.00	.....	$.095	$0.15	$.095*h*	....	$.095*s*	$.095	$0.115
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	23.00*o*	$34.00*o*	.0936*o*	.175*o*	.095*ho*	$.185*ho*	.095*o*	.103*o*	.195*o*
Chicago	150.00‡*y*	85.00/88.00*e*‡	3.10/4.15*d*‡	22.50*b*	32.00*b*	21.50*bg*	31.00*bg*	.097/.10*bh*	.....	.082/.0845*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	186.52	49.00*gg*	3.87*u*	30.00	40.00	29.50*g*	39.50*g*	.135*h*	.22*h*	.13	.20	.27
Dallas	*l*	40.00	*l*	23.38	42.17	.0987	.1837	26.15	46.65	.0962	.1037	....
Denver	.....	41.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	63.00*x*	.....	27.00	26.00	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.1522
Kansas City	.....	40.00*q*	.....	20.45*r*	.....	.....	.....	.081*hr*	.....	.07*r*	.....	.....
Los Angeles	*l*	.....	*l*	16.00*mf*	28.75*mfw*	16.00*gm*	28.75*mw*	16.50*m*	23.50*mw*	15.50*gm*	.0675*ee*	.1375*ee*
Minneapolis	.....	.....	2.79*d*	28.00	37.00	23.00*g*	34.00*g*	27.00	38.00	.105	.13	.23
Montreal	125.00	.....	.....	25.00*k*	31.25*k*	14.60*kp*	18.35*kp*	14.00*kp*	16.00*kp*	12.50*kf*	.153*k*	.194*k*
New Orleans	.....	.....	.....	20.00*a*	.....*s*	20.00*ga*	.....*s*	.095*hadd*	.....*s*	.095	.0975	.16*n*
New York	.....	.....	2.50*d*	26.50	38.86	25.50*g*	44.88*g*	.1090*h*	.1917*h*	.1040	.1090	.1897
Philadelphia	150.00	62.00	4.06	23.00	.....	22.00*g*	.....	.095*h*	.....	.....	.....	.....
Pittsburgh	165.00	42.00	4.50	26.00	39.00	.12	.24	27.00	42.00	.095	.10	.21
St. Louis	.....	48.50	.....	21.40	.....	.....	.....	.....	.....	.....	.1025	.....
San Francisco	.....	57.75*c*	.....	17.50*es*	32.00*wee*	17.50*geeff*	.....	19.50*ee*	.....	.....	.0725	.1425
Seattle	.....	.....	.....	16.50*i*	33.00*i*	15.00*ig*	.....	18.00*i*	22.00*aai*	16.00*ig*	.0675*i*	.0825

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40–80 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums, per drum. *k* Tax included. *l* Not used. *m* F.o.b. refinery, El Segundo. *n* 55 gal. drums. *o* Price at plant, in Everett. *p* Per 100 gal. *q* F.o.b. Buffalo. F.o.b. Sugar Creek, Mo. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *u* 3-in. *v* Bulk, refinery. *w* Shipped in steel barrels no longer in double head wood barrels. *x* Truck deliveries in Detroit $75.00 *y* Carload lots. *aa* In customer's drums. *cc* F.o.b. refinery, Inglewood. *dd* Medium curing. Rapid curing, $.0975; slow curing, $.0925. *ee* F.o.b. Richmond. *ff* 50–300 penetration. *gg* May-June price of $52 was for 4 x 3½ x 8½.

Tires on this 80-ton "hopper car" do a four-way job!

UNITS such as the 80-ton capacity trailer shown above are larger than most railroad hopper cars. But hauling coal in them over rough pit and haulage roads, mine to tipple, is all in a day's work at Hume Sinclair Mining Co., Pleasanton, Kansas.

Helping to make this hauling problem "routine" are the B.F.Goodrich *Universal* Silvertowns shown in the picture. It's a hauling job that could be a serious problem, for tires take a beating every inch of the way! The loads are extremely heavy, some roads are coal and rock strewn, and the pit roads are often slippery. Too, tires must *last* to help keep hauling costs down.

Read what Merle Guthrie, Mine Superintendent, has to say about B.F. Goodrich Universals . . . "this tread tends to prevent slipping when pulling out of muddy, slick pits. It also resists cutting from shale and rocks."

As to ability to stand up under loads and wear longer than ordinary tires — the answer is the B.F.Goodrich double nylon shock shield now built into all B.F.Goodrich off-road tires size 11.00/20 and larger.

The double nylon shock shield consists of four layers of *nylon* cord between the tread and the body plies. Under load and under impact, the strong, elastic nylon *shields the rayon cord body.*

Only B.F.Goodrich gives you the added protection of the double nylon shock shield . . . the additional saving through (1) longer tire life, (2) increased number of recappable tires, (3) increased bruise resistance, (4) less danger of tread separation.

There is a specially designed B.F. Goodrich off-the-road Silvertown for every need. See your B.F.Goodrich dealer or write us direct. *The B.F. Goodrich Company, Akron, Ohio.*

Truck Tires BY

B.F. Goodrich

IRON AND STEEL PRODUCTS—PER 100 LBS. BASE MILL PRICES

	STRUCT. SHAPES–PLATE	REINF. BARS billet *bz*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Net Ton: Standard	STEEL RAILS: Light	STEEL RAILS: Re-rolled	TRACK SUPPLIES: Angle Bars	TRACK SUPPLIES: Std Spikes *c*	TRACK SUPPLIES: Tie Plates *c*	TRACK SUPPLIES: Track Bolts
Birmingham	$2.75	$2.70	$5.65	..	....	$54.00/55.00	$61.00	Not	$3.75/3.85	$4.85	$3.55/3.65	$7.00
Chicago	2.75	2.70	5.65	....	$3.30	.....	.....	avail-	3.75/3.85	4.85	3.55/3.65	7.00
Pittsburgh	2.75	2.70/2.75	5.65	...	3.30	$54.00/55.00	61.00	able	3.75/3.85	4.85	3.55/3.65	7.00
Buffalo	2.80	2.75	....	....	3.30	.....	.....	....	....	....	3.55/3.65	....
Cleveland	....	....	5.65	...	....	.....	.....	....	....	....	....	....
Youngstown	....	2.70	....	....	....	.....	.....	....	....	4.85	....	....
Gary	2.75	2.70	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.75	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.424/3.474‡*	3.329‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports. On tie plates alone, Steelton, Pa.; on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per CL. *e* Mi lengths. Add 50¢ for cut lengths. * $3.343 for sizes produced at Geneva.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS *g* Per 100 lb., base price *u*: 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH *k* Per 100 sq. yd., carload lots: Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price
Atlanta	$5.225‡	$5.225‡	$5.225‡	$.025	$.10	$31.50	$33.50	$2.55/2.69	$1.76/1.85	$2.68/2.83	....
Baltimore	4.71	4.03*l*	....	....	.10	33.50	35.50	2.39/2.53	1.65/1.74	2.50/2.65	....
Birmingham	4.25	4.40	4.40	.05	.15	43.00*p*	45.50*p*	2.53/2.67	1.74/1.83	2.65/2.80	....
Boston	5.01‡	4.76‡	4.23‡*c*	....	.10/.15	29.15	31.15	2.47/2.61	1.70/1.79	2.59/2.74	$3.8432*k*
Chicago	4.35	3.50*ff*	3.50*ff*	.05	.05	28.00‡	30.00‡	2.20/2.34	1.54/1.63	2.31/2.46	3.30*a*
Cincinnati	4.80‡	3.883*c*	3.883*c*	....	....	30.00*zee*	32.00*zee*	2.38/2.52	1.65/1.74	2.49/2.64	3.708*d*
Cleveland	4.72	3.50*v*	....	....	.10	31.50	33.50	2.32/2.46	1.61/1.70	2.44/2.59	....
Dallas	6.72	5.00	5.00	....	....	32.50	35.00	2.64/2.78	1.81/1.90	2.76/2.91	....
Denver	5.95	5.80*e*	....	....	....	40.00*s*	45.50*qs*	2.66/2.80	1.82/1.91	2.79/2.94	5.89
Detroit	4.82‡	4.73	....	....	.10	33.50*x*	35.50*q*	2.38/2.52	1.65/1.74	2.49/2.64	3.683*gd*
Kansas City	5.35*ee*	4.23*aak*	4.23*aak*	....	.10	34.00	36.00	2.44/2.58	1.69/1.78	2.56/2.71	3.893*k*
Los Angeles	5.10*fhh*	5.10	....	....	....	41.00*fk*	....	2.74/2.88	1.87/1.96	2.87/3.02	4.64*djj*
Minneapolis	4.82‡	5.37*ccn*	5.37*ccn*	...	.15	31.50*k*	33.50*k*	2.44/2.58	1.68/1.77	2.55/2.70	3.89*k*
Montreal	4.90*i*	4.25*i*	4.25*i*	....	....	40.28*h*	42.98*h*	2.51/2.65	1.73/1.82	2.63/2.78	78.70*jdq*
New Orleans	....	4.73*ok*	....	.05	.10	32.00	32.00	2.52/2.66	1.73/1.82	2.64/2.79	.....
New York	4.82*r*	4.85	....	....	.15/.20	31.00*st*	33.00*st*	2.42/2.56	1.67/1.76	2.54/2.69	3.35*a*
Philadelphia	4.59	4.65	....	....	....	30.00‡	32.00‡	2.40/2.54	1.65/1.74	2.51/2.66	3.80
Pittsburgh	4.40	4.40	4.40	.05	.10	32.50	34.50	2.20/2.34	1.54/1.63	2.31/2.46	5.05
St. Louis	4.74‡	4.48*c*	4.48*c*	....	....	40.00‡	42.00‡	2.35/2.49	1.63/1.72	2.46/2.61	....
San Francisco	5.00*ii*	4.53	....	....	....	33.50	35.50	2.74/2.88	1.87/1.96	2.87/3.02	4.85
Seattle	3.777*e*	4.43*el*	....	....	....	35.00*w*	38.50*w*	2.74/2.88	1.87/1.96	2.87/3.02	4.576*dd*

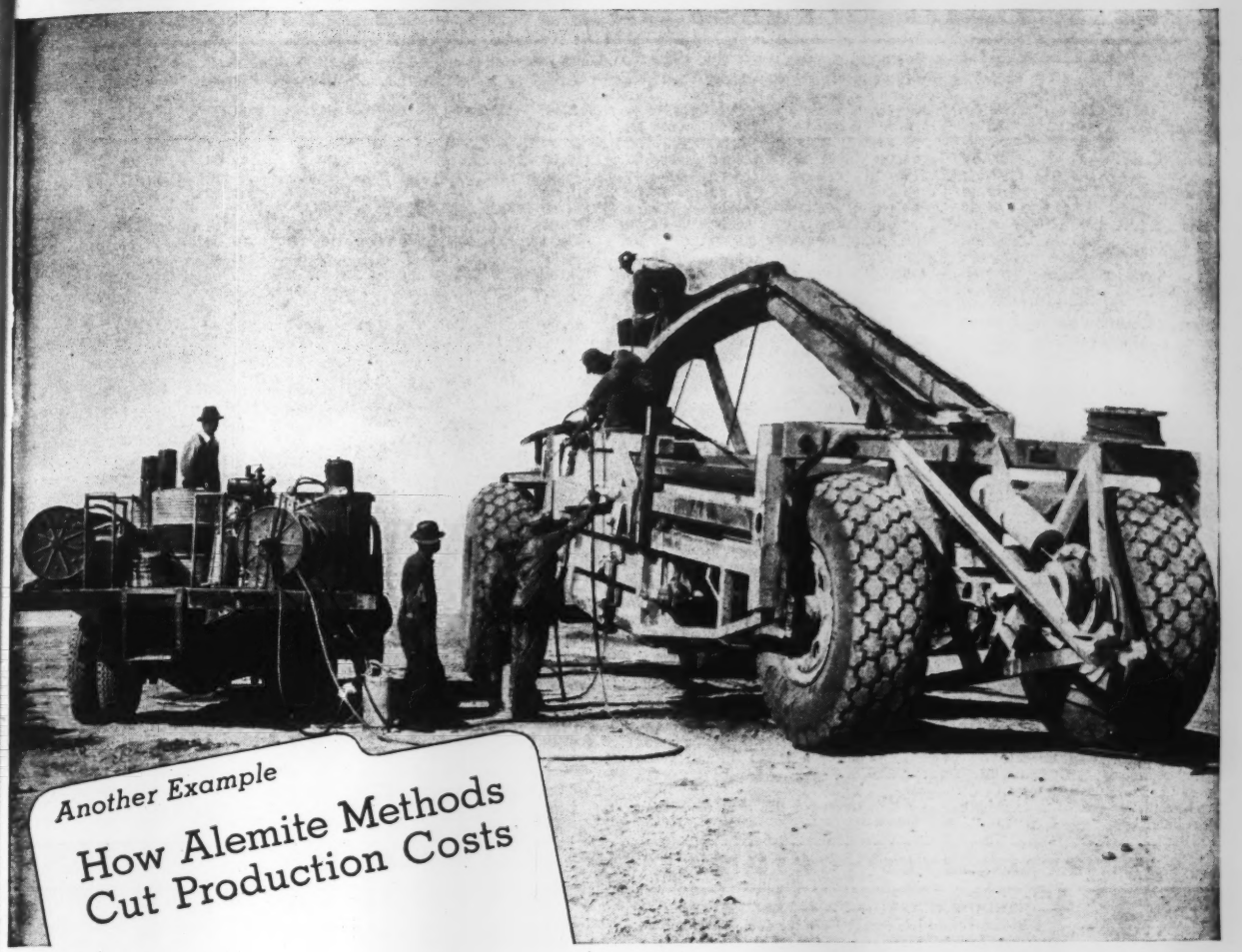
‡ Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plant *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate and hard grade, new billet. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed. 4 lb. per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10¢, ¾ in., ⅞ in. 15¢, ½ in. 20¢, ⅜ in. 35¢, ¼ in. 55¢, ⅛ in. $1.30. *v* Under 20 tons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. cars Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b. cars. *ff* Carload lots. *gg* Including sales tax. *hh* $4.95 if rolled at Geneva, Utah mills. *ii* Rolled at Geneva mill. *jj* From Chic. From Pitts., $4.81. * Correction.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13–44T: std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4–24 Per 1,000 ft., carload lots, f.o.b.: 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14–41: 12 in.	24 in.	WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination *t*) 2½ & 3 in., Butt Weld: Black %	Galv. %	3½ to 6 in., Lap Weld: Black %	Galv. %
Atlanta	$92.10	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	48.2	32.2	42.2	25.7
Baltimore	96.50	.378	.729	3.105	8.098	147.00	228.00	.80	2.20	51.9	35.9	45.9	29.4
Birmingham	85.50	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	48.2	32.2	42.2	25.7
Boston	99.90	392*uvz*	.756*uvz*	3.465*uvy*	8.7125*uvy*	150.60	233.40	1.03*gcc*	2.75*gcc*	50.2	34.2	44.2	27.7
Chicago	98.70	59	1.14	4.81	13.45	150.00‡	270.00‡	.65	2.25	54.0*t*	38.0*t*	47.0*t*	30.5
Cincinnati	97.20	.441	8505	3.51	9.53	154.80‡	241.20‡	.60	2.25	52.4	36.4	46 4	29.9*t*
Cleveland	99.30	.35*x*	.675*x*	2.97*x*	9 3025*x*	141.50	221.00	.65	2.50	54.7	38.7	48.7	32.2
Dallas	101.08	375	.675	2.70	6.20	109.00	131.00	.45	1.45	46.3	30.3	40.3	23.8
Denver	105.92	41*dd*	.71*dd*	2.98*dd*	....	.....	.....	.74*dd*	2.50*dd*	44.4	28.4	38.2	21.7
Detroit	99.30	.63	1.21	4.81	11.20	195.00‡*m*	303.00‡*m*	.55	2.20	52.9	36.9	46.9	30.4
Kansas City	100.42	.39*m*	.705*m*	2.78*m*	7.15*m*	175.00*m*	310.00*m*	.60*l*	1.90*l*	49.7	33.7	43.3	26.8
Los Angeles	112.30	.414	894	4.347	10.868	220.00‡	360.00‡	.65	...	....	....	....	....
Minneapolis	100.40	62*mo*	1.12*mo*	4.35*mo*	....	.....	.....	1.19*h*	3.18*h*	49.8	33.8	43.4	26.9
Montreal	78.20	.73*z*	1.28*z*	4.20*z*	6.80*ez*	.60*paa*	.48*paa*	72.00*jkaa*	218.00*jkhaa*	....	....	....	....
New Orleans	95.10	.412	.762	3.955	9.15	231.00*bb*	.....	.55	1.95	47.8	31.8	41.8	25.3
New York	95.50	.62	1.14	4.45	12.30	.....	.....	1.00	2.25	51.2	35.2	45.2	28.7
Philadelphia	93.30	.54	.99	4 08	10 25	235.00‡	390.00‡	1.25*h*	3 20*h*	51 7	35.7	45.7	29.2
Pittsburgh	99.82	.364*m*	.702*m*	2.70*m*	6.625*m*	130.20	197.40	1.05*h*	2.50*g*	55.0*t*	38.0*t*	49.0*t*	32.5
St. Louis	96.60	.46	.83	3.30	7.51	.....	.....	1.10*il*	2.30*hl*	51.6	35.6	44.7	28.2
San Francisco	112.30	.438*d*	.878*d*	3.69*d*	9.23*d*	169.00*dl*	282.00*dl*	.69	2.85	....	....	....	....
Seattle	114.10	.51*b*	.91*b*	....	....	150.00*c*	.....	.80	2.40	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, CL, Burlington, N. J. (base) $90.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in $5 per ton additional. 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200–44T. *c* 4-in., $90. *d* SS361-A. *e* 30 in. *g* Culvert pipe. Reinforced, ASTM C76–41. *h* Reinforced. ASTM C75–41. *i* Reinforced. ASTM C76–37. *j* Centrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed price is based on I.C.L. (no minimum). *p* Less than 5 ton loads, price per ft. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13–40. *v* F.o.b. city *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60–1941 specifications used. *aa* No standard specifications in Can. *bb* Freight allowed to destinations in city. *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL, delivered, f.o.b. truck **20% emergency freight rate increment granted railroads on Jan. 5 and May 6 freight rate increase (10% in East; 5% on average for U. S.) not included.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld — 1 in. and 1¼ in. black, 4, galv. +16.5; 1½ in. black, 9.5, galv. +13; 2 in. black 10½, galv. +12.5. Lap weld — 2½ in. to 3½ in. black 4, galv. +16; 4½ in. to 8 in. black 6, galv. +12. Freight rates to destination to be added to name delivered price.

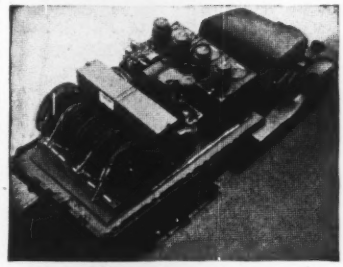


Another Example

How Alemite Methods Cut Production Costs

Cuts "Time-out" for Lubrication Up to 35.3%

Adds More Productive Time to Machines Through Portable Power Lubrication



You're Looking at a Modern Compact, Speedy Lubrication Unit

Actually, it's a super-service unit mounted on a light truck. Alemite Portable Service Stations come in various combinations. High and low pressure grease pumps, oil pumps and hose reels, plus all necessary connections and accessories. A five minute conference with an Alemite Representative may well give you the key to lower production costs through modern methods of handling and applying lubricants. Write to Alemite, 1821 Diversey Parkway, Chicago 14, Illinois.

Illustrated above is an Alemite Portable Service Station bringing *power* lubrication to a large earth-mover out on the job. Air-operated pumps deliver oil and grease direct from "barrel to bearing."

Important too, is the fact that this modern Alemite Method cuts "time-out" for lubrication as much as 35.3%—which adds up to more pay yardage from each piece of equipment on the job. The result is lower contract costs.

It's just one of many Alemite Methods now saving time, money and machines in every industry. And the Alemite Representative can quickly prove that his simplification of lubrication procedures can definitely reduce the cost of maintenance in any construction company.

He can show you case after case where a time study analysis proved that Alemite Methods eliminate costly, time-consuming handling of greases and oils. His methods completely mechanize lubrication from "barrel to bearing"... save grease ... keep dirt and moisture out of lubricants ... reduce bearing failures.

It costs nothing to get the facts. Why not get them, today?

ALEMITE

Another Product of STEWART WARNER

MODERN LUBRICATION METHODS THAT CUT PRODUCTION COSTS

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

SHORT LEAF YELLOW PINE AND DOUGLAS FIR

All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)
All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (*Prices in italics*)

	1x6 s4s	1x8 s4s	2x4 s4s	2x6 s4s	2x8 s4s	2x10 s4s	3x12 Rgh	6x12 Rgh	12x12 Rgh
Atlanta.....l	**$80.00**	**$82.00**	**$70.00**	**$70.00**	**$75.00**	**$76.00**	**$80.00**	.....	.....
l	*95.00*	*95.00*	*96.50*	*96.50*	*96.50*	*96.50*	*87.50*	*$87.50*	*$87.50*
Baltimore.....	**96.00**	**96.00**	**96.00**	**95.00**	**100.00**	**104.00**	**115.00**	.....	.....
	106.00	*108.00*	*112.30*	*112.00*	*114.00*	*114.00*	*121.00*	*121.00*	*121.00*
Birmingham...l	**90.50**	**90.50**	**87.00**	**86.00**	**87.00**	**90.00**	**110.00**	.....	.....
l	*95.50*	*95.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*102.00*	*105.00*
Boston.....	90.00‡	90.00‡	92.00‡	92.00‡	92.00‡	98.00‡	100.00‡	.....	.....
	98.00	*98.00*	*98.00*	*98.00*	*98.00*	*98.00*	*105.00*	*105.00*	*105.00*
Chicago.....‡	**96/98**	**100/102**	**88/90**	**88/90**	**88/90**	**95/97**	**100.00**	.....	.....
‡	*103.00*	*108.00*	*100.00*	*100.00*	*100.00*	*105.00*	*105.00*	*105.00*	*105.00*
Cincinnati.....	**100.00**	**100.00**	**100.00**	**95.00**	**102.00**	**110.00**	.....	.....	.....
Cleveland.....	**92/95**	**92/95**	**82/89**	**82/89**	**82/89**	**87/94**	.....	.....	.....
Dallas.....l	**71.00**	**71.00**	**61.00**	**59.00**	**61.00**	**66.00**	**80.00**	.....	.....
Denver.....	*96.00o*	*96.00o*	*101.00o*	*97.50o*	*97.50o*	*98.50o*	*109.00o*	*117.50o*	*116.50o*
Detroit.....	**96.00**	**96.00**	**90.00**	**90.00**	**94.00**	**92.00**	.....	.....	.....
	92.00	*92.00*	*92.00*	*92.00*	*92.00*	.....	.....	.....	.....
Kansas City....b	**110.00**	**110.00**	**100/103**	**100/103**	**105.00**	**105.00**	.....	.....	.....
b	*110.00*	*110.00*	*100/103*	*100/103*	*105.00*	*105.00*	*110.00*	*135.00*	*135.00*
Los Angeles....a	*104.00*	*104.00*	*103.00*	*103.00*	*103.00*	*103.00*	*111.00*	*120.00*	*110.00*
Minneapolis...‡b	117.00e	117.00e	.....	.....	.....	.....	.....	.....	.....
‡b	*108.00*	*108.00*	*108.00*	*108.00*	*108.00*	*110.00*	*130.00*	*130.00*	*130.00*
Montreal....c	73.00	76.00	70.00	72.00	76.00	85.00	.....	.....	.....
	111.55	*111.55*	*111.55*	*111.55*	*111.55*	*111.55*	*120.00*	*87.00*	.....
New Orleans...l	**90.00**	**90.00**	**75.00**	**80.00**	**80.00**	**77.00**	**85.00**	.....	.....
l	*68.00*	*68.00*	*70.00*	*67.00*	*67.00*	*67.00*	*71.00*	*67.00*	*72.00*
New York.....‡	**95/100**	**95/100**	**Range from $90.00 to $95.00**				**110/115**	.....	.....
‡	.....	.....	*Range from $110.00 to $115.00*				*120/125*	*120/125*	*120/125*
Philadelphia...			**Range from $100.00 to $110.00**				**100/110**	.....	.....
			Range from $110.00 to $120.00				*110/120*	*127.00*	*127.00*
Pittsburgh.....l	**75.00**	**77.00**	**80.10**	**80.10**	**85.25**	**89.70**	**107.75**	.....	.....
l	*93.60*	*93.60*	*83.00*	*83.00*	*87.00*	*91.00*	*110.00*	*116.00*	*118.00*
St. Louis.....‡j	**95.00**	**99.50**	**89.50m**	**94.50m**	**101.50m**	**106.00m**	.....	.....	.....
‡j	.....	.....	*111.00n*	*116.00n*	*116.50n*	*116.50n*	.....	.....	.....
San Francisco..d	*81.00*	*81.00*	*81.00*	*81.00*	*81.00*	*79.00*	*79.00*	*79.00*	*79.00*
Seattle.....l	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*75.00i*	*75.00i*	*75.00i*

LONG LEAF Y. P. Merchantable grade up to 20 ft.

2x12 Rgh	12x12 Rgh
.....	.....
.....	.....
193.60	182.00
.....	.....
120.00	117.50
.....	.....
.....	.....
105.00	105.00
125.00	125.00
.....	.....
145.00	.....
.....	.....
72.00	80.00
.....	.....
.....	.....
.....	.....
.....	.....
105.00	105.00
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
100.00	105.00
.....	.....
175/200†	175/200†
.....	.....
180.00	180.00
.....	.....
130.20	141.00
.....	.....
.....	.....
.....	.....
.....	.....

PLYWOOD Rail freight increment* (See note for base price)

5/8"	1/2"
$22.32	$27.24
.....	.....
22.86	27.90
.....	.....
21.78	26.58
.....	.....
22.86	27.90
.....	.....
18.72	22.80
.....	.....
21.78	26.58
.....	.....
22.20	27.12
18.72	22.80
13.92	16.98
21.78	26.58
.....	.....
16.56	20.16
.....	.....
13.38g/h	16.26g/h
16.56	20.16
.....	.....
.....	.....
.....	.....
18.72	22.80
.....	.....
22.86	27.90
.....	.....
22.86	27.90
.....	.....
22.56	27.48
.....	.....
18.72	22.80
.....	.....
10.08g	12.30g
.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* ‡ Spruce. ¶ Western Pine No. 3 Common. ‡ Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Direct mill prices; f.o.b. purchasers carrier or truck. *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truck load in Greater Cleveland. Less 2% for cash. Truck lots. *l* F.o.b. mill. *m* 8 to 12 ft. lengths. *n* 8 to 16 ft. lengths. *o Correction.* Prices unchanged since Jan. 1948.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ½", $179.00; on ¾", $210.00. For other centers add rail freight increment from table on proper size. For oiling add $3.00; for edge sealing add $2.00; for resin sealing add $8.50.

* Freight rates include 20% emergency increase granted railroads on Jan. 5.

† 18 ft. and under.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS Discounts from jobbers list, Jan. 16, 1946a Single or Double Thickness A quality	B quality	EXPLOSIVES Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
Atlanta	76%	76%	$0.195
Baltimore	70–10%	71–10%	.195
Birmingham	68%	68%	.15
Boston	77%	78%	.195
Chicago	68%	68%	.195
Cincinnati	67–6%e	67–6%e	.195
Cleveland	67–10–10%	67–10–10–10%	.235
Dallas	65%	65%	.2075
Denver	68%	68%	.20
Detroit	67–10–10%	67–10–10%	.195
Kansas City	68 10%e	68–10%e	.20
Los Angeles	62%	67%f	.2025
Minneapolis	68%	68%	.20
Montreal	40–5%bc	40–10–5%bc	18.90h
New Orleans	68%	68%	.205
New York	73%	74%	.265g
Philadelphia	69%	70%	.195
Pittsburgh	70–10%	70–10%	.1675
St. Louis	70–10%	70–10%	.20
San Francisco	66%	73%	.20
Seattle	57%	58%	.2025

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

Glass; *a* Jobbers' list price per box, 14 x 20, ss, $20.75 for A quality, $18.00 for B quality; 14 x 20, ds, $30.75 for A quality, $26.00 for B quality. *b* Discount from list, Sept. 1939; sales tax included, but 6% tax exemption not allowable for. *c* Single thickness. *e* Discount from list of Aug. 15, 1938. *f* ss; ds—67%.

Explosives: * Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas. *g* In borough of Kings, Queens, and Richmond and in Manhattan south of Canal St., add delivery charge of $9.00 per trip. *h* F.o.b. city per 100 lb. forcite, 40%, 60%, $20.65.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 –.1625	.18 –.1925	.20 –.2125
Rocky Mtn. States	.155 –.1675	.18 –.1975	.20 –.2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 –.1575	.18 –.1875	.20 –.21

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail Pine*	By Rail Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.— 2-ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.— 2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.— 2-ft. from butt	6-in.	90 to 100-ft.	....	.72
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.73
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.80
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.43	.74
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.54	.75
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.57	.76
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.80

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.45	.....	$2.00	.....
	Pine	1.35	$3.05a	1.90	$4.00a
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60a	....	2.25a
Chicago	Red Oak	....	2.50/2.55a	....	3.25/3.40a
Los Angeles	Douglas Fir	1.86	3.25a	....	....
Philadelphia	Red Oak	2.33	3.13a	3.10	4.25a
St. Louis	White Oak	1.75	....	2.45	....
	Red Oak	1.70	2.35a	2.40	3.40a
	Sap Pine or Cypress	2.20a	....	....	....
San Francisco	Douglas Fir	1.60e	2.80f	2.10b/f	3.88ca/
Montreal	Birch or Maple	....h	....h	....h	....h

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *e* Empty cell. *e* Green. *f* F.o.b. cars. *h* No constant price available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

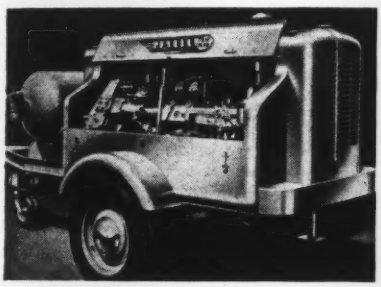
Bleaching powder in drums f.o.b. works, per 100 lb.	$3.75
Chlorine cylinders, liquid, per lb. f.o.b. works	.07–.12
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, f.o.b. works, ton	22.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.65
Soda ash, 58%, in paper bags, per 100 lb. dense	1.38
Sulphate of aluminum, commercial, in 100-lb. bags f.o.b. works	1.15–1.30
Sulphate of copper, in bags, per 100 lb f.o.b. works	7.60

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

EDITOR'S NOTE: In the following columns are Road Show Preview items that were received too late for inclusion in the special Road Show insert also in this issue.

M-R-S MANUFACTURING CO., FLORA, MISS.—New model 110 Mississippi wagon, designed for hauling by M-R-S 125 tractor carries 17-ton payload and has 11-yd. struck capacity; 16½-yd. heaped. Exclusive weight-transfer device on 239-in. wheelbase wagon puts extra load on rear tractor tires when greater traction is needed. Weight is transferred through hydraulic cylinder mounted between trailer and tractor. Wagon has instantaneous opening, hydraulic wind doors which open bottom to full body width. Electric four-wheel brakes are synchronized with foot brakes of tractor. Model 90 wagon is a lighter unit with 16-ton payload 14-yd. heaped capacity. Other models are for hauling behind M-R-S modification of International wheeled tractors.



JAEGER MACHINE CO., COLUMBUS, OHIO—Capacities of Jaeger's Air-Plus portable compressors have been increased by 15 to 20 percent in New Standard models, without increase in over-all dimensions. New capacities are 75, 125, 185, 250, 360 and 600 cfm., designed to give 30 to 40 percent greater daily production through full-pressure air to tools.

JOY MANUFACTURING CO., SULLIVAN DIV., PITTSBURH, PA.—Interchangeable wheel brackets on Joy one-man wagon drill allow gage reduction from 51 to 36 in. for narrow bench operation. Drill guide on universal-type saddle has extreme angular flexibility which, with simple brakes that lock wheels and make anchor pins unnecessary, gives quick setups. Along with compressors and tunnelling equipment —drifters, jumbo mountings and loader —Joy has Silver Streak rock drills and breakers. Cadmium plating on these units prevents rust and also scoring should lubrication fail.

WORTHINGTON PUMP & MACHINERY CORP., HOLYOKE, MASS.—Rigid alignment through 3-point engine and compressor suspension, full force-feed lubrication and easy-breathing valves make Blue Brute 60- to 500-ft. portable compressors tight and efficient. Hand-held rock drills have positive-acting, end-seating valves, forged yoke-type retainer, rifle bar construction and blower valve for hole cleaning while drill is running. Blue Brute UMW-40 wagon drill features lifting crank for U-arm adjustment, and air motor with wide feed range.

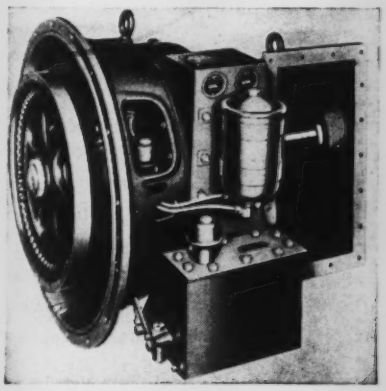
BARCO MANUFACTURING CO., CHICAGO, ILL.—Improved Barco gasoline hammers have more-easily opened carburetor valve and new holding clip that prolongs cable life at handle. Tools are 90-lb. heavy-duty and 78-lb. lightweight paving breakers, and 80-lb. drill for surface rock drilling up to 3 ft.

CONTINENTAL MOTORS CORP., MUSKEGAN, MICH. — Continental's pride is new 50-lb. 1½-hp. portable power source, or Multi-Tool, for operating variety of shop and field equipment without electric motors. Built-in control on gasoline-driven unit maintains desired speed, pre-selected on simple 1,600 to 2,600-rpm. range dial, regardless of load.

DAVEY COMPRESSOR CO., KENT, OHIO—Da-V-Lite is new self-contained portable flood or spotlighting outfit with 5,000-watt generator powered by 4-cylinder air-cooled engine. Unit is 2-wheel mounted; carries four lights on extensible shafts.

MASONRY SAWS—New features of a saw for cutting brick, tile, concrete and fire brick are dual belt drive, snap-on blade cover, streamlined positions for instant one-man change, and fully adjustable conveyor clamps, both elevating and non-elevating types. A multiple cutting action reduces frictional heat, requires less power and keeps the blade sharp for faster cutting and longer blade life.—*Clipper Mfg. Co., 2800 Warwick, Kansas City 8, Mo.*

RIPPER—New 17-ton ripper is strong enough to take pull of three or four tractors and can penetrate 6 ft. of hard ground, and operates with one, two or three rooter shanks. Recommended for deep-penetration ground breaking ahead of ditchers on pipe line or cable laying jobs. Overall width is 13 ft. 5 in., overall length 25 ft. 7 in.; rooter shank is 10 ft. 4½ in. x 18 in. x 5 in.—*Soule Equipment Co., 760 Ferry St., Oakland 7, Calif.*



TWIN DISC CLUTCH CO., RACINE, WIS.—To provide cushioned power transmission in construction machinery, Twin Disc has hydraulic couplings that prevent shock-load damage, dampen torsional vibrations; and hydraulic torque converters that multiply torque for changing speed and load requirements. Converter applies most effective ratio to meet existing conditions of imput and load, thereby giving smooth, quick uninterrupted acceleration.

Each Gurley Instrument carries this unqualified guarantee

"No transaction shall ever be considered closed where any dissatisfaction is known to exist on the part of the customer, who is assured of courteous and fair treatment without regard to the extent of his business."

BECAUSE Gurley instruments are engineered and manufactured to exacting standards—

BECAUSE all parts are made in the Gurley plant (which even has its own foundry)—

BECAUSE of continuous instrument research for over 100 years—

Whether you're a beginner or a seasoned specialist, it's a wonderful feeling to know you can buy with complete confidence, as have four generations of engineers before you. At Gurley you will find the added advantage of an engineering organization with field experience, where the field man's problems are known and understood (a heritage of the first William Gurley, an engineer and surveyor himself).

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W. & L. E. GURLEY—Union Plaza—Troy, New York

GURLEY

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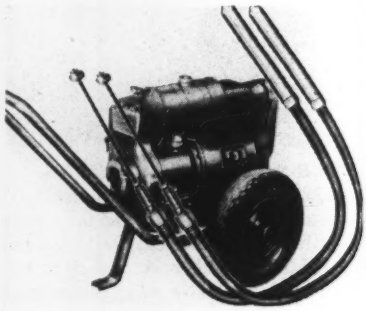
Surveying and Engineering Instruments, Hydraulic Engineering Instruments, Standard Precision Weights and Measures, Paper and Textile Testing Instruments, Aeronautical Navigating Instruments, Meteorological Instruments, Reticle Making Facilities.

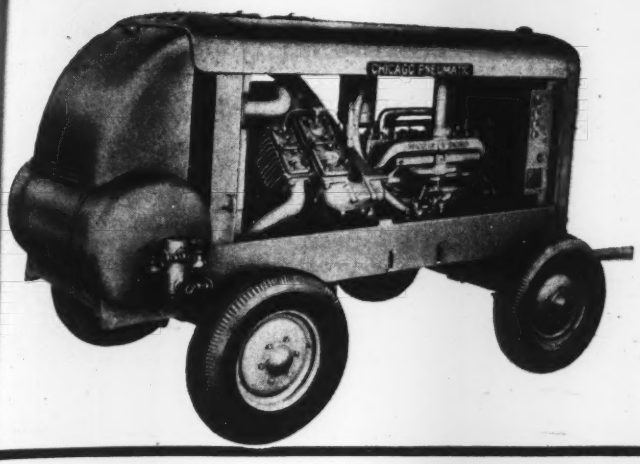
VIBER CO., BURBANK, CALIF.—Viber flexible shaft vibrators—electric, air or gasoline driven—have motors, drives and 1¾- to 3-in dia. heads interchangeable on all models. Rigid-shaft, pneumatic, 60-lb., 4⅜-in. dia. vibrator is available for heavy-duty work in mass concrete. Viber multiple unit for full-depth road slab vibration is mounted on any spreader or finisher 11 to 25 ft wide. Tilt and depth of immersion of these electric-drive vibrators is hydraulically controlled by machine operator. All Viber units have greater than 9,500 rpm. speed in concrete.



CHICAGO PNEUMATIC TOOL CO., NEW YORK, N. Y.—New pair of high-frequency concrete vibrators with companion 2-kw. portable generator make efficient team for working 30 to 40 cu. yd. of concrete per hr. With no flexible shafts, vibrators are easily handled; can operate at any distance from generator by adding electric extension cord. Frequency of 2½ x 19-in. head is 10,000 vibrations per min.

BETHLEHEM STEEL CO., INC., BETHLEHEM, PA.—In addition to Safety-Beam and cable guard rails, cold-rolled tubular bridge rail, and combination bridge guard rail and hub guard, Bethlehem features complete dowel assembly for road joint. Unit comes in two halves to which alternate dowels have been welded, and which are slipped together after insertion of filler strip. Assembly is rigid, lightweight (84 lb. for 12-ft. slab), nestable for shipping, and holds dowels to correct alignment and level.

AMERICAN BRAKE SHOE CO., NEW YORK, N. Y.—Products furnished by American Brake Shoe division to contractors and construction equipment manufacturers by American Brake Shoe's divisions include: Amsco manganese steel shovel dippers and hard-surfacing welding rod; National brass and bronze bearings and precision machined parts for tractors and earth-movers; American forgings for power shovels; and Brakeblok linings and heavy-duty brake blocks. Kellogg divi-



ECONOMICAL OPERATION AT ANY SPEED

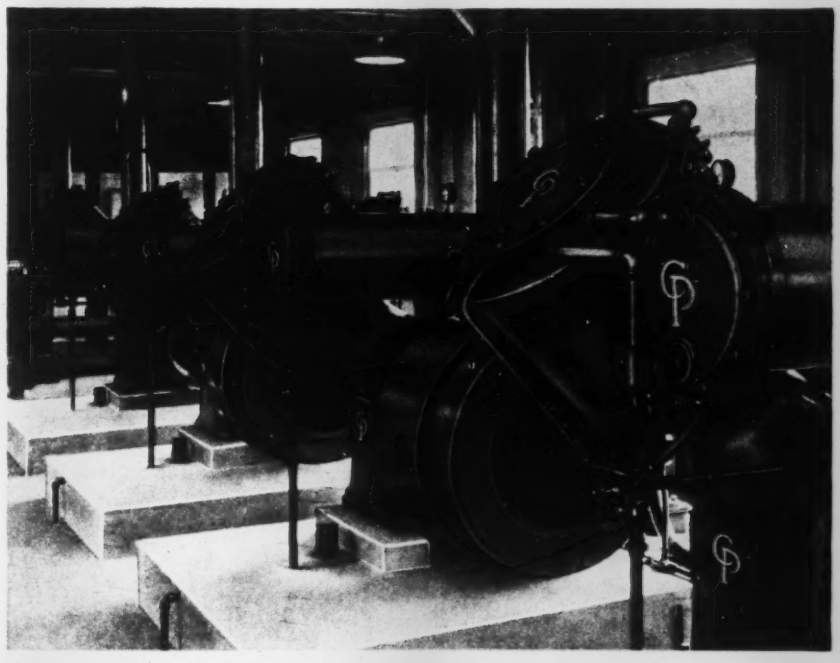
The contractor always can count on economical operation of a CP Portable Air Compressor, because the CP gradual speed regulator adapts engine speed to air demands, holding fuel consumption to a minimum. This and other CP features effect fuel savings of 15% to 35%.

CP Portable Compressors are available in gasoline-driven models of 60, 105, 160, 210 and 315 c.f.m., actual capacity, and in Diesel-driven models of 105, 160, 210, 315 and 500 c.f.m.

IT'S EASY TO INSTALL

Shipped intact as a "package unit," ready for external connections, a CP Type Y Compressor can be set up quickly with minimum expense. It needs only a simple foundation and requires no special skill to install. Its compact design makes it ideal where floor space is restricted.

CP Type Y Compressors are available with built-in or direct-coupled motor, or with V-belt drive, in capacities of 500 to 900 c.f.m., at 80 to 125 pounds pressure. Sizes for other pressures also furnished.



CP UTILITY WINCH

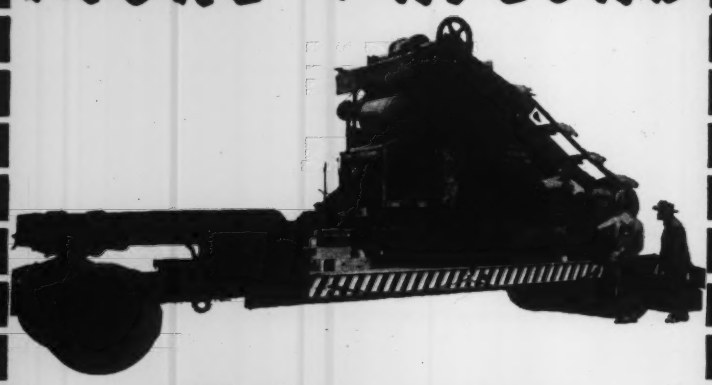
Powered with gasoline, electric or air motors, CP Utility Winches have a wide range of applications—single or multiple line hoisting, spotting cars, handling timber and structural steel, etc. Precision control is provided through clutch and brake levers.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

MORE PAYLOAD



with less tractor and manpower

These strong, rigid lowbeds are built for one purpose only —to get heavy equipment on the job at the lowest possible cost in time, tractor and manpower. Engineered for easy pull; *built to take the load;* this W-W Lowbed has a 25 ton rated capacity but its actual load limits are determined only by size and condition of tire equipment.

Heavy duty oscillating axles carry 8 tires in line. The free, independent crosswise action of the oscillating axles assures even load distribution on all tires at all times regardless of road contours. Heavy duty railroad type coil springs cushion road shock, assure long trouble-free frame life.

Heavy 14" x 10" structural steel frame ... 2" hardwood planking laid flush with main frame beams; flat gooseneck for additional loading space; all necessary tractor connections; *PLUS* a choice of body types are other advantages of the W-W 25 "SA" model. This W-W Lowbed is available in a skid-loaded model or with a beavertail and exclusive loading ramps enabling one man to load self propelled equipment.

Immediate delivery is available on any model from 10 to 60 ton capacities. For pictures and complete specifications simply attach coupon below to your letterhead and mail today.

The WINTER-WEISS Co.

2201 BLAKE STREET Dept. E DENVER 2, COLORADO

Gentlemen: Please send me complete information on your Lowbed trailers. We are particularly interested in a_____ton model.

Firm Name_____

Address_____

City_____ Zone____ State_____

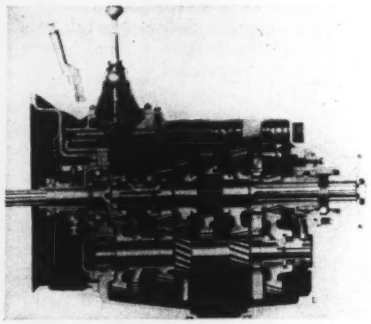
By_____ Title_____

sion has new Micro-Spray Gun as well as other paint-spraying and compressor equipment.

STERLING MACHINERY CORP., KANSAS CITY, MO.—Additions to Sterling's equipment are new self-priming centrifugal pumps, gasoline-engine-driven saw table, electric welders, and power-driven diaphragm pump. Other units are hoists, saws and generators.

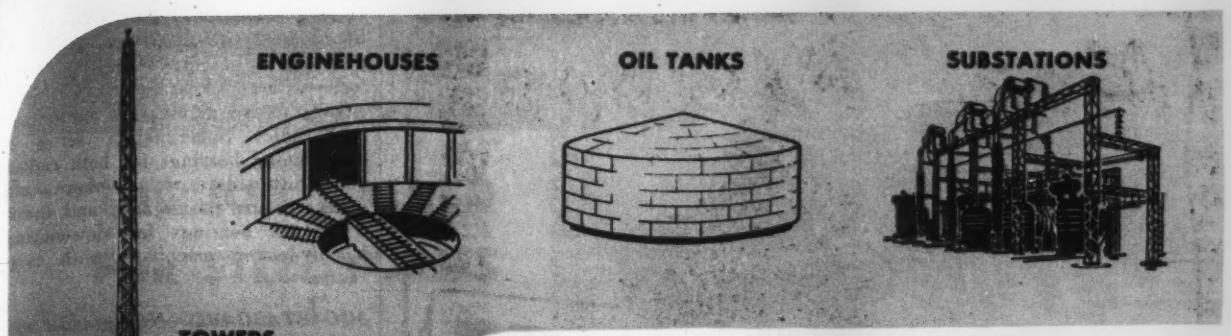
CALCIUM CHLORIDE ASSOCIATION, WASHINGTON, D. C.—Proper use of calcium chloride in road construction and maintenance is shown in series of association pamphlets. Some of calcium chloride's multiple uses are in ice control, surface consolidation, curing concrete and weighting tractor tires.

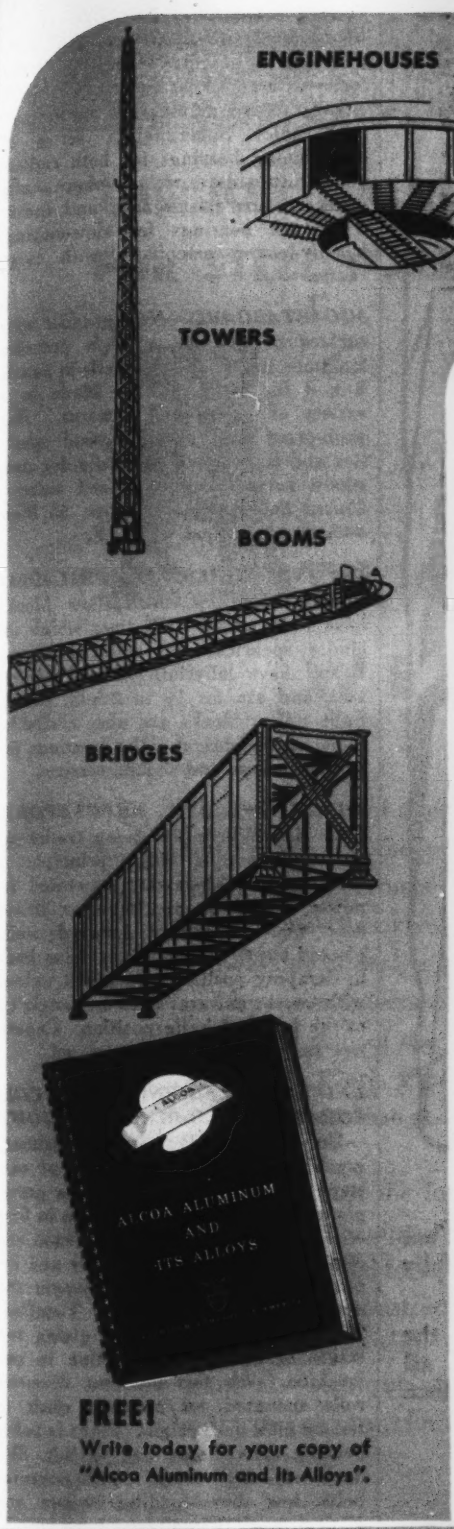
HYDRAULIC EQUIPMENT CO., CLEVELAND, OHIO—New Hydreco VB control valve for hydraulic systems of bulldozers and front-end loaders has built-in relief valve and flow control for improved operation of equipment requiring up, down, float and hold positions. Also new is combination pump, valve and tank in ½- to 3-gpm. range.



FULLER MFG. CO., KALAMAZOO, MICH.—With all helical gearing in forward speeds, three point bearing suspension for main shaft and maximum capacity bearings in all positions, Fuller's new five speed transmission, Model 5A1120, will handle largest engines for on- or off-highway service. This extra-large transmission is built for engines with piston displacement up to 1,120 cu. in., weighs 681 lb. with standard controls, and is 31 in. long.

SISALKRAFT CO., CHICAGO, ILL.— Sisalkraft blankets for curing and protection of concrete now give 15 or more re-uses as each sq. yd. has 2,800 ft. of sisal fiber embedded in high quality asphalt between two chemically processed Kraft paper sheets, all combined under heat and pressure. Tough, airtight and waterproof, Sisalkraft is easily spread or removed by two men; comes in rolls 3 to 7 ft. wide, blankets up to 26½ ft., and in covers to 25 x 30 ft.





START designs in Aluminum

make strength-to-weight larger, make cost-per-pound smaller

Forget tradition! *Start* your designs and calculations in Alcoa Structural Aluminum. Make maximum weight savings over steel at lowest cost with no sacrifice in structural strength.

Aluminum weighs only ⅓ as much as steel of equal cross section. You can use bigger aluminum sections to increase structural rigidity, and still save as much as 50% in weight over steel.

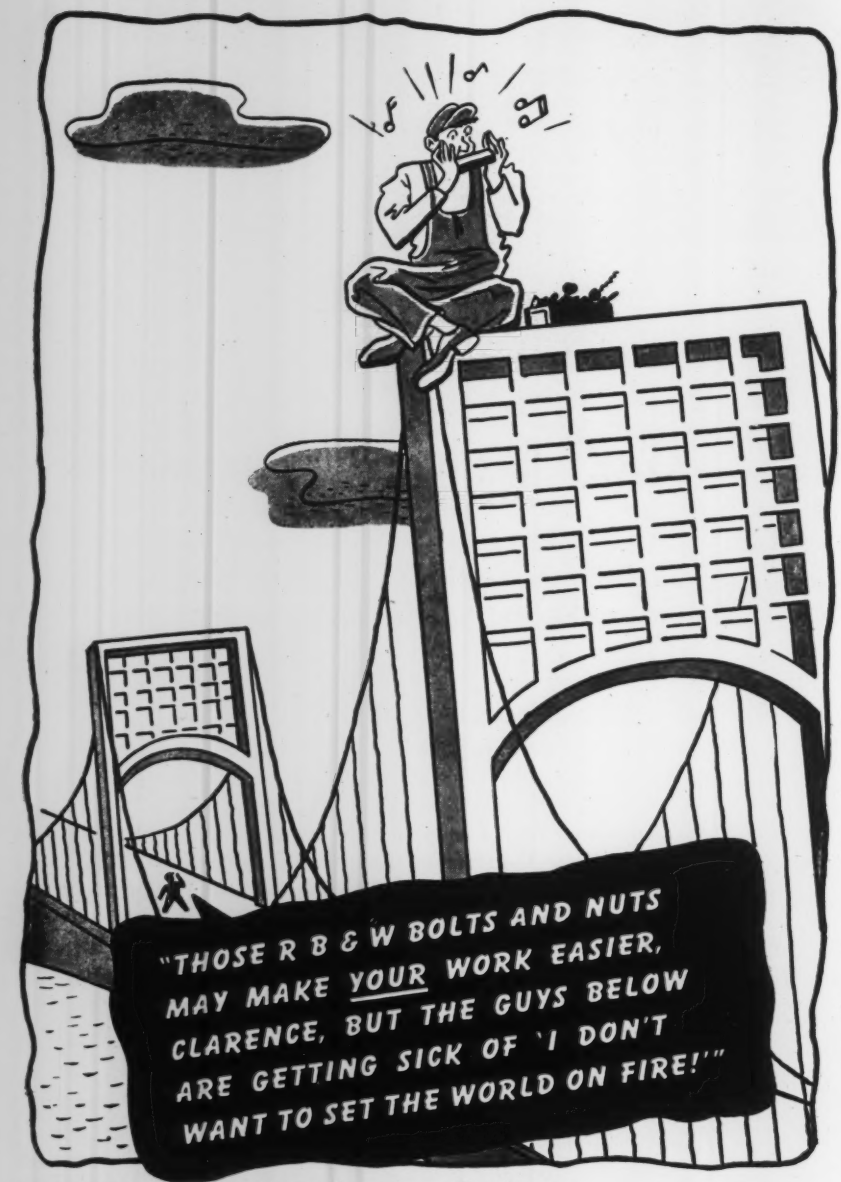
You save on maintenance and painting. Aluminum will not rust red in most industrial and chemical atmospheres, is not readily attacked if paint is damaged or neglected. For many applications, use aluminum bare and save the cost and inconvenience of maintenance painting.

Alcoa Aluminum Structural Shapes are made in many standard rolled shapes, plus hundreds of strong extruded shapes that cannot be made in steel. Alcoa also makes strong aluminum sheet, plate, and tread-plate, and a complete line of aluminum rivets, screws, and bolts for fastening aluminum structures with aluminum.

If you need engineering data or a copy of the 154-page "Alcoa Aluminum and Its Alloys", write to ALUMINUM COMPANY OF AMERICA, 2108 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in 54 leading cities.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE


"THOSE R B & W BOLTS AND NUTS
MAY MAKE YOUR WORK EASIER,
CLARENCE, BUT THE GUYS BELOW
ARE GETTING SICK OF 'I DON'T
WANT TO SET THE WORLD ON FIRE!'"

Use R B & W Bolts and Nuts . . .

Quick-starting, quick-tightening because they are accurately, uniformly sized and threaded — and carefully inspected.

Vibration-resisting, shock-resisting because the manufacturing method insures extra strength, and all processing is controlled from raw rod to finished product.

EMPIRE BOLTS NUTS RIVETS — AND ALLIED FASTENING PRODUCTS . . . SINCE 1845

RB&W *Making strong the things that make America strong*

Russell, Burdsall & Ward Bolt and Nut Company. *Factories at* Port Chester, N. Y., Rock Falls, Ill., Coraopolis, Pa., Los Angeles, Calif., *additional sales offices at* Philadelphia, Chicago, Detroit, Chattanooga, Oakland, Portland, Seattle

HYATT BEARINGS DIVISION, GENERAL MOTORS CORP., HARRISON, N. J.—Hyatt bearings include: Hy-Load series with non-separable races, or with either race separable and parts interchangeable; Spherangular series of self-aligning bearings for both radical and thrust loads, especially where shafts deflect or are misaligned; and Industrial Inch bearings for slow-moving, heavily-loaded machinery with large shafts.

MICARTABOARD—New product with surface of Micarta, a high pressure laminate, is available for walls in panels 4 x 8 ft., $\frac{5}{32}$ in. thick. Made in a variety of colors and patterns. Has stain-proof and abrasion-proof qualities and is designed primarily for uses where surfaces receive hard wear.—*United States Plywood Corp., 55 West 44th St., New York 18, N. Y.*

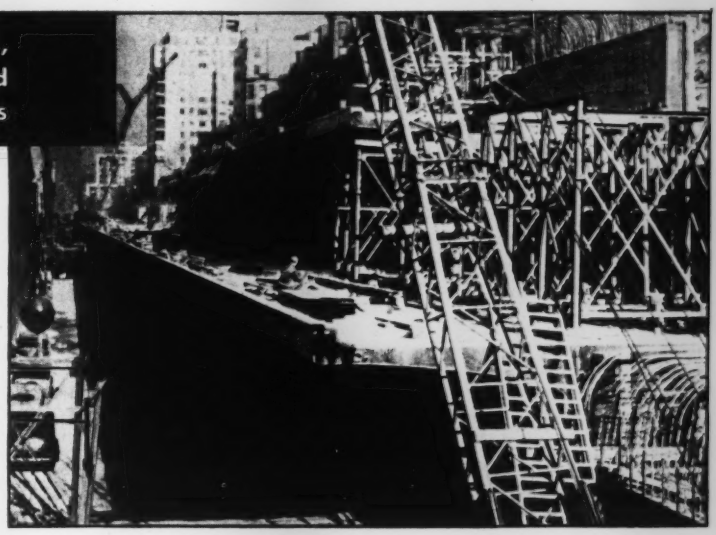
SKF INDUSTRIES, INC., PHILADELPHIA, PA.—New unit pillow blocks have been added SKF line, which includes spehrical and roller bearings. Blocks have labyrinth instead of felt seal, and are for $\frac{1}{2}$ to $2\frac{7}{16}$-in. shafts. Split pillow blocks are also available, some with spehrical roller bearings for trunion rollers and shaker screens.

WINCH LIFT, INC., SHREVEPORT, LA.—New Winch-Lift dump trailer incorporates simple lifting principle: a block and tackle system operated by power winch on truck-tractor drives rear wheel assembly forward while pivoted struts automatically raise body to dumping position. Unit will unload with tractor and trailer at any angle up to the full jack-knife position. Capacities range from 6 to 20 cu. yd.

UNIVERSAL ENGINEERING CORPORATION, CEDAR RAPIDS, IOWA—Universal 546-P portable primary crushing unit, steps up output of one-stage quarry plants or converts gravel plants to rock plants. Available in four crusher sizes—18x24, 20x36, 24x36 and 30x42 in.—unit has bar grizzly and by-pass, heavy plate steel feed hopper and apron feeder. Universal's TwinDual Master is portable crusher giving two stages of secondary reduction in one machine, with two different diameter rolls mounted on common shaft to reduce bulk and weight. Plant is roller bearing throughout; has 3x10-ft. 3½-deck vibrating screen, 30-in. conveyor belts, low shovel-loading hopper and 12-tire, 3-axle chassis.

ACME IRON WORKS, SAN ANTONIO, TEX.—Newest Ingram roller is 5 to 8-ton tandem with shock-resistant box-type yoke, rolls of fabricated steel plate and variable weight. Among other Ingram rollers are 3-wheel, variable- or

Cantilevered in Three Tiers, This Concrete Highway Created Puzzling Construction Problems

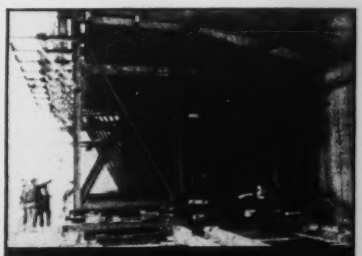


THE JOB CALLED FOR STEEL FORMS

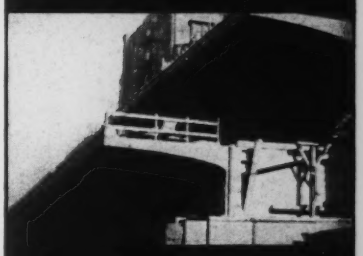
ATLAS STEEL FORMS WERE SPECIFIED

The conception of a highway in three tiers of concrete roadways, the two lower tiers for vehicular traffic, the uppermost a walkway, all cantilevered above a busy Brooklyn waterfront street, called for innovations in design and construction, brilliantly met by the engineers of the Del Balso Construction Corp., the staff of the Concrete Forms Corp. and Andrews & Clark, Engineering Consultants to the Borough President of Brooklyn.

The solution of the form problems was found in Atlas Labor Saving Forms, which again proved that they reduce form costs, speed up completion, and facilitate construction. Our engineers will be glad to discuss your form problems—routine or unusual—with you, and are prepared to furnish estimates on forms for any type of poured concrete construction.



Atlas Forms have just been shifted into new position for next pour.



One and one half miles of exacting steel plate facer fabricated by Concrete Forms Corporation.

Forms being put into position on traveler. Note simplicity and ease. Only one man and crane assembling.

CFC
CONCRETE FORMS CORPORATION
IRVINGTON 14, NEW YORK

KINNEY

BITUMINOUS DISTRIBUTORS

NOW BETTER THAN EVER

New Distributor Bar

Circulating spray bars—Cartwright type—with improved piping which eliminates cold spots. Includes a new system for more effective circulation of solvent without waste.

Simple Control

Manual controls for all loading, circulating, and spraying operations. Alternately, at additional cost, can be supplied for air control with one valve to regulate circulating and spraying.

Reduced Weight

New aluminum outer jacket reduces weight . . . eliminates rusting. Compact Hercules engine delivers high HP.

Rapid Application—Rapid Heating

Only Kinney Distributors are equipped with famous Kinney Jacketed Rotating Plunger Pumps—they apply all grades of bitumen as accurately as a meter. Efficient two-burner heating units permit safe heating of as little as 1/5 capacity.

Write for Bulletin A

KINNEY MANUFACTURING COMPANY

3527 Washington Street, Boston 30, Mass.

New York • Chicago • Philadelphia • Los Angeles • San Francisco

We also manufacture Vacuum Pumps, Liquid Pumps and Clutches

BRUNSON SURVEYING INSTRUMENTS

With Dust Proof Ball Bearing Spindle

Transits

Levels

Builders' Levels

Level Rods with Engraved Plastic Face

Manufactured by

Brunson Instrument Co., Inc.

1405 Walnut Kansas City 6, Mo.

constant-weight types from 5 to 12 tons, with five forward and five reverse speeds and all-welded frames.

WAUKESHA MOTOR CO., WAUKESHA, WIS.—Largest of three new Waukesha diesel engines is 6-cyl., 1,197-cu. in. model rated 190-210 hp. Engine has Waukesha combustion chamber, controlled oil piston-cooling system, hardened wet sleeve cylinders, chrome plated top piston rings, Stellite valve seats, and built-in oil cooler. Others are 775-cu. in. 6 cyl. diesel rated 150-180 hp., and 40 to 53-hp. six with 265-cu. in. displacement.

VICKERS INCORPORATED, DETROIT, MICH.—Vickers hydraulic equipment for road and construction machinery includes hydraulic controls, Power Pack, and steering booster unit that keeps backlash and road shock from steering wheel. Booster has integral overload relief valve and automatic lubrication.

BLAW-KNOX COMPANY, PITTSBURGH, PA.—Hydraulically controlled sectional cutting edge of Blaw-Knox Precision Subgrader for concrete paving work vibrates 2,000 times per min. to disintegrate rather than compact earth during excavation from between forms. Unit rides on road forms or adjacent slab and has two winches that pull it forward on anchored cables. Reverse power is through chain drive to wheels. Elevating conveyor casts excess dirt aside. Machine tows 2-wheel strike-off that is adjustable for crown and width. Two Subgrader models—10-13 ft. and 20-25 ft.—are both powered by 32-hp. engine.

AEROIL PRODUCTS CO., INC., WEST NEW YORK, N. J.—Heet-Master Double Vat kettle for melting and heating rubberized asphalt joint sealing compounds is built like double boiler. Oil heated by liquefied petroleum burner circulates in outer chamber and through pipe grid in inner chamber so compound is heated indirectly. Unit is thermostatically controlled, heavily insulated, and has mechanical agitator that thoroughly stirs melt in screened compartment directly before draw-off.

KOHLER CO., KOHLER, WIS.—Electric lighting plant—1,500 w., 115 v. ac. —has built-in exciter and automatic voltage regulation. Gasoline engine-driven plant starts automatically when light or tool of 40 watts or more is turned on, and stops when current is no longer required.

NOVO ENGINE CO., LANSING, MICH.—Single-cylinder air-cooled Novo engines with 22.7 and 33.2-cu. in. displace-

In Galveston Bay, huge rotary drilling rigs bore nine thousand feet under the sea for oil. Long strings of pipe put tremendous shock loads on wire rope. TRU-LAY Preformed stands up extremely well even under such treatment.

Breaking up hard-packed earth is the first step in building a flood control dam in Nebraska. These earth-breaking machines put constant gruelling strains on the wire rope. Here again, TRU-LAY Preformed gives longer, lower cost service.

ALL AROUND AMERICA

Hoisting a completely loaded box car onto a Seatrain for over-water journey from Edgewater, N. J., to Texas City. TRU-LAY Preformed is hard at work every day on thousands of huge overhead traveling cranes like these—giving good service.

Far down below ground in West Virginia's soft coal fields, under-cutting machines claw at the walls of coal. Here wire rope is expendable. TRU-LAY Preformed of correct construction adds many extra hours of service—lowers over-all costs.

ACCO

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Tacoma, Seattle, Bridgeport, Conn.

AMERICAN CABLE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

In Business for Your Safety

Tru-Lay *Preformed* **Wire Rope**

FOR SPANS UP TO 180 FEET
A STANDARD CATALOGED
ITEM WITH **MACOMBER**

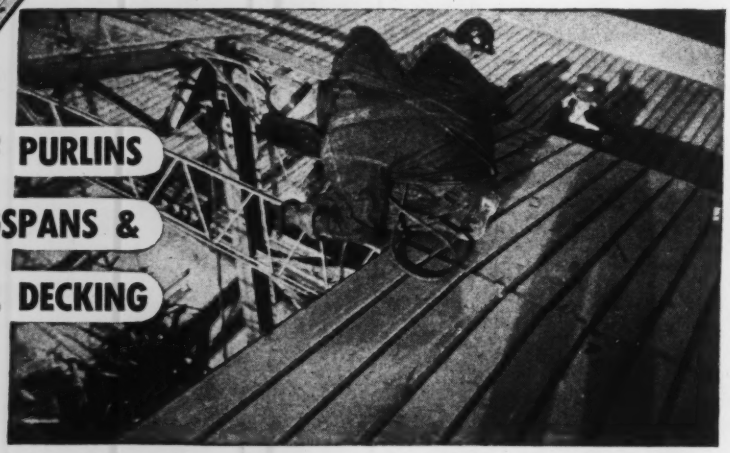
MACOMBER BOWSTRING ROOF TRUSS

DESIGN STANDARDS have been established for all sizes of Macomber Trusses. You can order by catalog number for the required load and span. We have absorbed this colossal engineering task through years of concentration in this field.

RESULT — an accurately engineered, bow-string truss in the quantity you need, laid down at the building site at very nominal cost.

YOUR COMPLETE ROOF SYSTEM — Macomber Trusses, Purlins or Longspans and Steel Decking delivered on schedule from one source warrants investigation. Write us.

ALSO
ROOF PURLINS
LONGSPANS &
STEEL DECKING



V-BAR JOISTS AND PURLINS • V-STUDS • TRUSSES • LONGSPANS • DECKING

MACOMBER
INCORPORATED
CANTON, OHIO

STANDARDIZED STEEL BUILDING PRODUCTS

ment have extra-hot spark from automatic impulse coupling to magneto. Governor maintains speed within 5 percent, despite varying loads on gasoline units. Novo 2- and 4-cylinder water-cooled engines have similar hot spark and governor control and displacement of 66.4 and 133.0 cu. in. respectively.

MURPHY DIESEL CO., MILWAUKEE, WIS.—Skid-mounted 6-cyl. ME-66 diesel, 150 brake hp. continuous and 180 intermittent, has four valves per cylinder for higher output and lower valve temperature. Engine has unit fuel injector that serves as pump and nozzle for each cylinder and eliminates high pressure fuel lines. Solid fuel is injected directly to open combustion chamber.

GORMAN-RUPP CO., MANSFIELD, OHIO—High-speed priming at all suction lifts through design that eliminates valves, vents and mechanical devices is highlight of Gorman-Rupp's line of centrifugal contractors' pumps. Impeller is only moving part. Sizes range from 7M, 2-in .to 125M, 8-in.; and include 40M, 4-in. pump that primes in 36 sec. at 15-ft. suction, and in 65 sec. at 25-ft. New 90M, 6-in. model primes in 21 and 44 sec. at same suction heights.

BARNES MANUFACTURING CO., MANSFIELD, OHIO—Barnes portable centrifugal pumps for contractors—from 3M, 1½-in. lightweight Flash to 90M, 6-in. heavy-duty Master—have non-clogging, trash-type impeller and automatic suction valve that opens wide when pumping, yet closes tight to retain priming water. New Peri-Prime feature, with free-passage vent, primes pump fast with as little as ⅓ normal water level in body.

MARLOW PUMPS, RIDGEWOOD, N. J.—Lightweight (64 lb.) aluminum-body Marlow 12A-2 pump is self-cleaning, with three-vane impeller, and can handle a maximum ½-in. size solid particle. With AGC 3M rating, 1½-in. pump primes automatically by Marlow diffuser method that eliminates auxiliary primary devices. Other centrifugals and Mud Hog diaphragm pumps are joined by new space—saving vertical centrifugal that is self-priming and electrically driven.

WHITEMAN MANUFACTURING CO., LOS ANGELES, CALIF.—Hauling loads of 2,000 lb. or 12 cu. ft. at speeds from 2 to 12 mph. Whiteman Power Buggy is motorized wheelbarrow powered by 6-hp. air-cooled gasoline engine. Power Buggy weighs 750 lbs., is narrow enough to pass through doors, and has real wheel drive with 360-deg. rotating mountings so it turns in own radius and can go in reverse. On Whiteman

you'll NEVER make it!

So you're rushing to see EVERYTHING at the ROAD SHOW? Better slow down, Mister . . . you'll never make it in a month of Sundays! Too much to see, to hear, to talk about . . . too many old and new friends to greet . . . too many prospects and customers who want to "talk turkey."

So why not plan your time *selectively*! Seek out the exhibits that will benefit your business . . . your interest in building better roads will lead you first to RIDDELL.

Here you'll see the brand new WARCO Motor Grader . . . with valuable engineering advances. Inspect, too, the heavy-duty HERCULES Road Rollers. Meet our domestic and export representatives.

Yes, your time will be profitably invested with RIDDELL . . . your confidence well placed in WARCO and HERCULES.

See you at Soldiers Field July 16 to 24

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THE W. A. RIDDELL CORPORATION • BUCYRUS, OHIO

No other Instrument gives you

SO MUCH PROTECTION!

NOTICE the leveling screws on the instrument leveling head above. See how they are always totally enclosed — regardless of their position "in" or "out". This means all dust and dirt are sealed out — their precision sealed in.

This is just one of the many extra protective refinements, extra features that guarantee you extra-long life and super precision results with David White Instruments. There are other things too — the waterproof compass box, the overall weatherproof morocco finish—coated optics—hand-fitted, anti-friction, virgin hard, bell metal centers—plus the David White improved engraved plate levels with counter adjusting springs.

Yes, for instruments that guarantee you the extra in precision and long life you want — it's David White . . . makers of finest quality instruments for over 40 years. For detailed information about the complete David White line of Transits, Universal Level Transits, Levels, Theodolites and engineering supplies, write today for Catalog No. 1048.

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We offer the most expert Repair Service — on all makes of Instruments.

315 West Court St. Milwaukee 12, Wis.

concrete floor finishing machines, new quick-detachable float trowels are now standard equipment. Snap-On floats fit over machine's regular finishing blades and are attached or removed in a few seconds.

NOVO ENGINE COMPANY, LANSING, MICH.—Novo Scootruk is mechanized wheelbarrow that carries operator as well as 1-ton load. Three-wheel unit has 6-hp. air-cooled gas engine, speeds up to 15 mph., rear-wheel steer with 5-ft. turning radius, and 14-cu. ft. dump body.

OWEN BUCKET COMPANY, CLEVELAND, OHIO—Hinge stop that holds bottom sheave block upright, and broad counterweight shaped to protect cables and sheaves from contact with abrasive materials, give Owen clamshell buckets longer service life. Grit-proof bearings for Alemite-lubricated center shaft minimize wear on hinge castings.

RANSOME MACHINERY CO., DUNELLEN, N. J.—For high output with small concrete mixer, Ransome Blue Brute non-tilt 3½S has charging hopper, at convenient shoveling height, that holds second batch while first is being mixed. Larger 6S non-tilting mixer is also 2-wheel mounted and has cable-operated charging skip that vibrates when dumping to drum. Ransome truck mixers—horizontal and Hi-Up high-discharge types—have improved single-lever controls with two speeds forward and reverse and automatic brake to hold drum. Features of single and dual-drum 31E Blue Brute pavers is long boom with 171-deg. swing and hydraulic control that permits swinging of boom and discharging of bucket at same time to spread batch on subgrade.

FRANK G. HOUGH CO., LIBERTYVILLE, ILL.—Payloader Buggy is gasoline engine-driven four-wheel hauling unit whose 2-cu. yd. dump body is raised and lowered by two hydraulic rams. Rig has two forward and two reverse speeds, hydraulic brakes and rear-wheel steer.

FOOTE CO., INC., NUNDA, N. Y.—For small jobs and patch work, Foote 3-cu. ft. Kinetic asphalt mixer produces batch every 30 sec. by new mixing principle. Aggregate, held by centrifugal force to face of 65-rpm. mixing drum, is peeled off and deflected by stationary blades until it is thoroughly mixed with asphalt injected under pressure into midst of deflected material. Another Foote machine is Adnun Black Top paver with hydraulic controls, drive on both front wheels and rear rollers. Cutter-bar strike-off is close ahead of rollers, which ride on completed pavement, so surface irregularities are small, and are corrected in successive courses.

MESABI IRON ORE vs.

ESCO 3-yard cast weld dipper on 1201 Lima stripping overburden at Rhude & Fryberger mine, Hibbing, Minn.

Stripping ore in the Mesabi Iron Range is rugged work that usually calls for heavy, rock-type buckets. Yet, working in this range are a number of *ESCO's* lighter weight Cast-Welded dipper buckets. They are on the job consistently, delivering greater payloads than would be possible with heavier buckets. In addition, they relieve some of the load on the machines.

Strength Without Excess Weight

Excess weight is eliminated by hollow back beam construction and by the use of *ESCO* Manganese Steel for the dipper front and all other parts subject to wear and shock. This steel polishes and becomes harder and tougher in use, which makes it unnecessary to make parts excessively heavy in order to allow for wear.

Designed for Efficient Digging

Clean cutting front with integral tooth bases and flaring outside teeth give clean, full bite. Tapered box permits quick, complete load discharge.

Result of efficient design and elimination of excess weight is more passes every hour, and more payload with every pass.

Ask for Detailed Information

In addition to the Cast-Welded dipper bucket, *ESCO* makes the heavy, all-cast type for extremely severe work, and dragline buckets of medium, standard and heavy duty types. Your nearest *ESCO* representative will give you full details of all these buckets. Or fill in and mail the coupon below for free illustrated catalogs. Electric Steel Foundry, 2167 N.W. 25th Avenue, Portland 10, Oregon; 716 Porter Street, Danville, Illinois. Offices in Eugene, Oregon; Chicago, Honolulu, Los Angeles, New York City, San Francisco, Seattle, Spokane. In Canada, ESCO Limited, Vancouver, B.C.

ELECTRIC STEEL FOUNDRY
2167 N.W. 25th Ave., Portland 10, Oregon
Please send catalog on ☐ Cast-Welded dipper; ☐ All-Cast dipper; ☐ Medium dragline; ☐ Standard dragline; ☐ Heavy Duty dragline.

Name_____

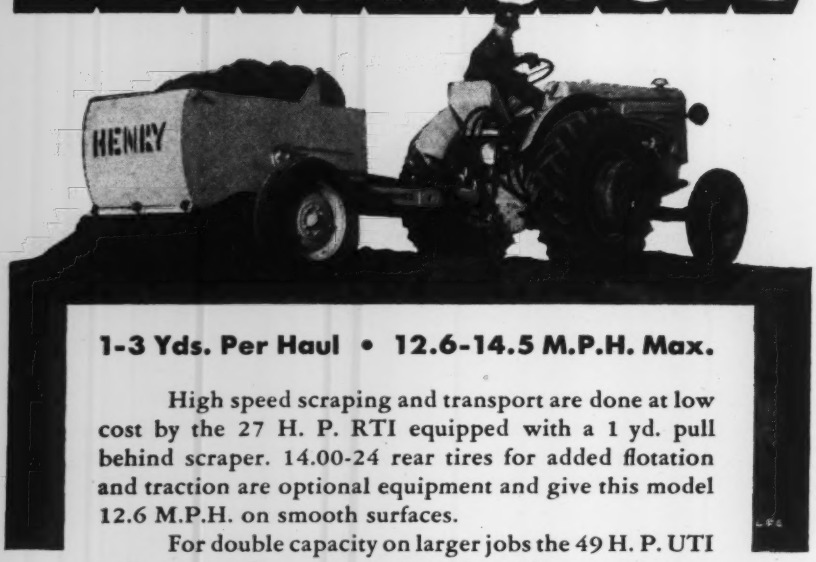
Address_____ Zone_____

City_____ State_____

ESCO

DRAGLINE • DIPPER BUCKETS

MM INDUSTRIAL... Earthmovers



1-3 Yds. Per Haul • 12.6-14.5 M.P.H. Max.

High speed scraping and transport are done at low cost by the 27 H. P. RTI equipped with a 1 yd. pull behind scraper. 14.00-24 rear tires for added flotation and traction are optional equipment and give this model 12.6 M.P.H. on smooth surfaces.

For double capacity on larger jobs the 49 H. P. UTI pulls a 3 yard scraper. 18.00-26 10-ply rear tires are optional equipment that provides more flotation and a 14.5 M.P.H. road speed.

BE SURE TO ASK ABOUT...

the *MM UTIL for front end loaders.* This is the first reverse transmission equipment of its type and gives operators *6 reverse speeds up to 14.5 M.P.H.* MM Industrial Tractors give you easiest steering offered in this type of equipment.

Plan to see MM Modern Industrial Tractors and Power Units on Display at the Road Show in Chicago

MINNEAPOLIS-MOLINE MODERN MACHINERY

MINNEAPOLIS-MOLINE
POWER IMPLEMENT COMPANY
MINNEAPOLIS 1, MINNESOTA

PHILIPS AND DAVIES, INC.
KENTON, OHIO

Designers and Builders of High Head Sluice Gates, Hoists, Cranes and Allied Equipment For Dams.

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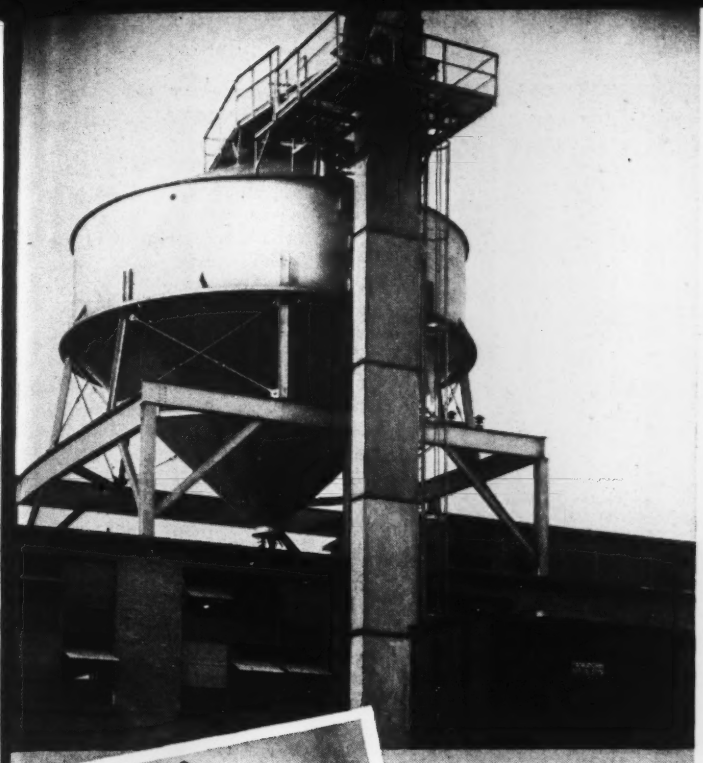
OVERBURDEN DRILL—A new 9-in. dia. rotary drill bit is useful for drilling overburden that contains hard shale or slate, limestone and some types of sand rock. The hard points of the bit cut three different paths to form a cutting or breaking pattern of three concentric rings in the bottom of the hole. The prongs of the bit are set 120 deg. apart and twisted at 15 deg. from vertical to accelerate the movement of cuttings away from the point and to provide a stronger edge to resist impact.—*Kennametal, Inc., Latrobe, Pa.*

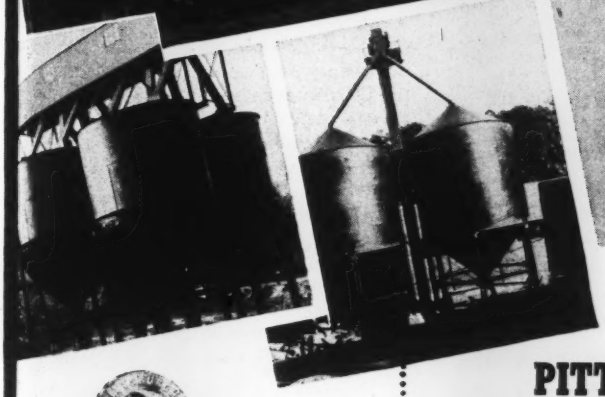
C. S. JOHNSON COMPANY, CHAMPAIGN, ILL.—Extra-large fill valve on Johnson All-Purpose bin give high-speed multiple aggregate batching. All-welded, 3-compartment bin for single batcher has capacities up to 120 cu. yd.; that for twin batchers has up to 135-yd. capacity. New Lo-Bin Trolley Batcher, 7½ ft. high, is easily charged by shovel or front-end tractor loader. Two compartments, with two fill valves under each, dump material to 22 cu. ft. hopper that rides on trolley and dumps beyond end of track. Another new unit is Johnson's Elevating Charger that unloads cement from box or hopper-bottom cars.

GALION ALLSTEEL BODY CO., GALION, OHIO—Galion's group of hydraulic hoists and dump bodies includes 3-yd. model 12 and 4-yd. LD 12 as well as heavy-duty roller-bearing pumps and heavy-duty 10-in. hoists. LD 12 body is 10 ft. long; 6½ ft. wide.

BROOKS EQUIPMENT AND MFG. CO., KNOXVILLE, TENN.—Load Lugger is multiple-body method for hauling materials with trucks. Easily installed on any standard truck chassis, Load Lugger has hydraulic hoisting mechanism and frame that picks up loaded container, places it on truck for transport, dumps or spreads load, or deposits entire container at destination. Unit is one-man operated from truck cab, and has jack-leg that extends to ground and locks in position to support rear truck overhang and relieve chassis strain while container is raised or lowered.

ROGERS BROTHERS CORPORATION, ALBION, PA.—Ordinary dump truck serves as tractor to pull Rogers Tagalong trailer which is loaded, unloaded and towed by dump truck operator alone. Tagalong loads and unloads from front after easy disconnection from dump truck, and can handle light and medium shovels, cranes, bulldozers, etc. Other Rogers trailers are type T rocking-beam unit, type D rear assembly with 16 rear wheels on laterally and longitudinally oscillating





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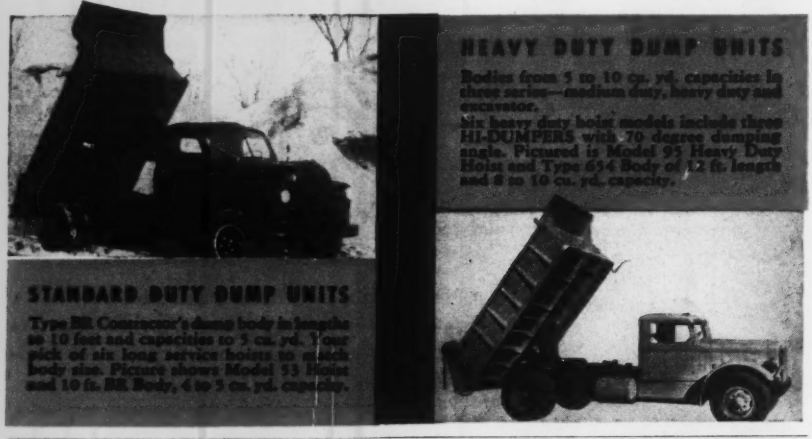

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axles, and 8-wheel rear assembly of type H drop-deck trailer.

WHITE MOTOR COMPANY, CLEVELAND, OHIO—With rugged construction and mechanical efficiency engineered to exacting requirements of road building, White trucks powered by White Super Power engines are designed to operate on and off highway under heavy load without undue stress.

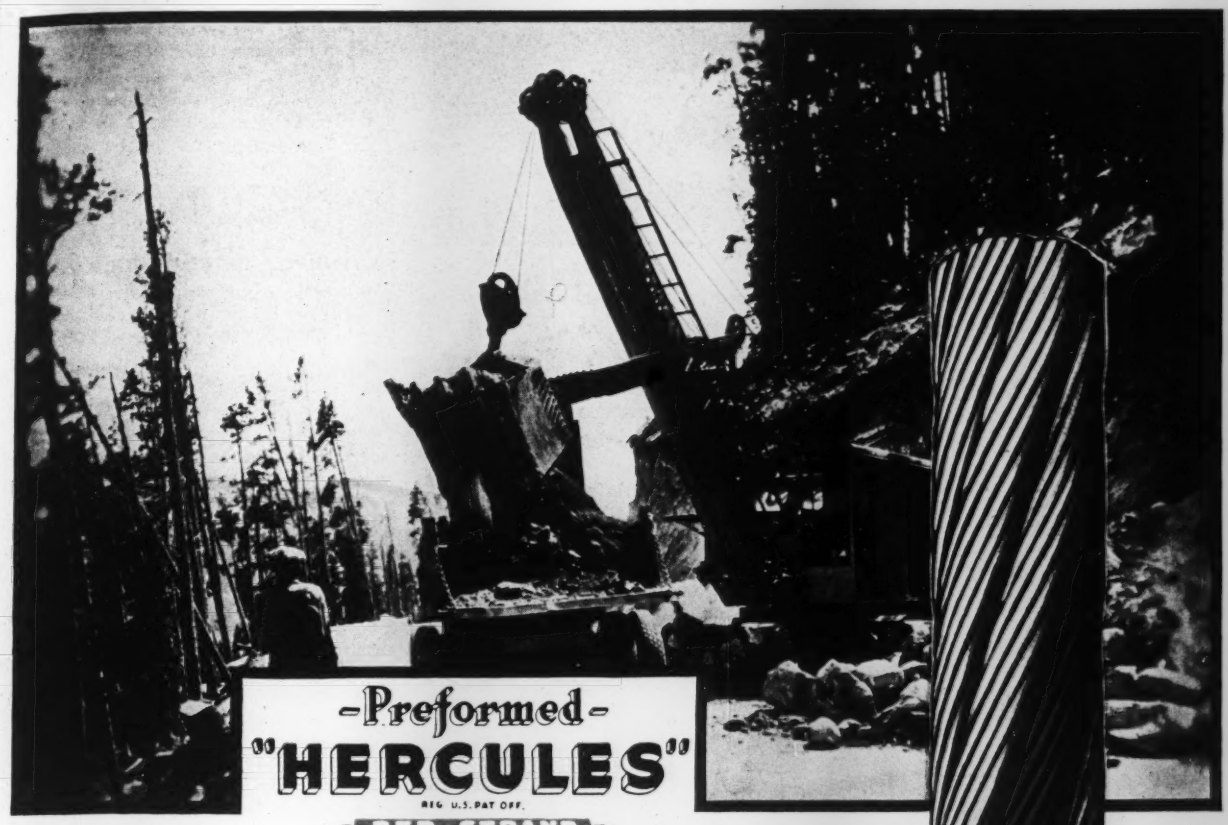
WILLETT MANUFACTURING CO., GRAND RAPIDS, MICH.—Hydraulic control on Willett Maintainer-Plow for under-truck mounting rotates, tilts or reverses moldboard and blade. Hydraulic shock absorber cushions moldboard from road shock to prevent gouging or washboarding, yet may be cut out for rigid blade operation.

HUBER MANUFACTURING CO., MARION, OHIO—Designed specifically for year-round road maintenance, Huber Maintainer is four-wheel tractor unit with 9-ft. scraper blade slung below. Three-ton unit has 108-in. wheelbase, 15-mph. road speed in fifth gear, 32-hp. gas or diesel engine, and hydraulic brakes and blade control.

ADJUSTABLE SPREADER — Wall forms are spread and held in line by the Williams Adjustable Form Aligner, shown as part of an assembly of Williams form hardware. The spreader is made up of two parallel bars which may be clamped in any position on the footing. Before form erection the spreaders are placed on the threaded projection of anchor-bolts placed in the footing concrete. Chalk lines are snapped for the interior sheathing surface position and the spreader ends are moved to the chalk lines. A nut and a crimped washer hold down the spreader.—*Williams Form Engineering Corp., Box 925, Madison Square Station, Grand Rapids 7, Mich.*

AXLE SHIFT CONTROL — Automatic electric shift now available for Eaton heavy-duty, two-speed axles used on trucks with capacity of 3 tons or more, permits driver to change from low to high axle ratio and back by flick of finger without declutching or releasing accelerator. Advantages: (1) Assures more positive action with less possibility of failure; (2) easier to service and simpler to install. Also available is semi-automatic electrical control which requires clutch and accelerator action but is more positive than present shifts. —*Eaton Manufacturing Co., Cleveland, Ohio.*

GUNNISON MANUFACTURING CO., BARABOO, WIS.—For spray bar control on its new trailer-type water tank.



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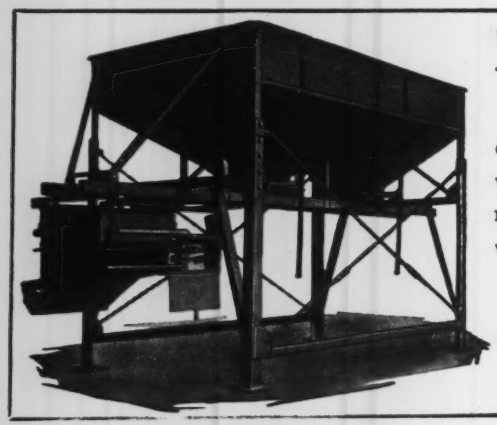

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CATERPILLAR TRACTOR CO., PEORIA, ILL.—Latest refinements to Caterpillar's D8 crawler tractor are increased hp. (130 drawbar, 144 belt) and constant mesh transmission. Transmission gives five forward speeds up to 4.8 mph., three reverse to 3.7 mph. and permits quick shifting while on the move. Separate gear-type oil pump pressure-lubricates bearings and sprays oil on gears. Lightweight master clutch with large brake reduces inertia for faster shifting and is easily serviced without disturbing engine or transmission. Supplementing new D8 are Caterpillar's smaller crawlers and DW10 wheel-type tractor. Earthmoving accessories include bulldozers, scrapers, wagons, rippers and control units, and line is rounded out by diesel engines and generator sets.

TRACKSON CO., MILWAUKEE, WIS.—Tractor-mounted construction equipment by Trackson include Traxcavator shovels, side-boom cranes for pipe laying, brush rakes and treedozers for land clearing. Treedozer on front of Caterpillar D8 has high-lift (100 in.), 12-ft. knockdown beam that bends trees over to loosen roots, and heavy, V-shaped plow that digs under roots and lifts them out. Beam and plow are independently operated by double drum cable control unit. Treedozer clears 12-ft. path through underbrush and trees at 2 to 3 mph.

DAYBROOK HYDRAULIC CORP., BOWLING GREEN, OHIO—Hi-N-Lo air-entrained concrete body for trucks has three hydraulic hoists that raise it to 70-deg. dumping angle and maximum 7-ft. 3-in. dumping height. With control levers at rear, 4-yd. body carries 3 yd. of concrete and can handle other materials as well. Daybrook also has new triple tandem hoist for dumping up to 30-ton loads on semi-trailer bodies, and Speedlift hydraulic tail gate that raises 1-ton load from ground to truck bed level.

HARNISCHFEGER CORP., MILWAUKEE, WIS.—Featured in arc welding electrodes and equipment by Harnischfeger is trailer or skid-mounted welder with 30 to 260-amp. service range. Unit is driven by 4-cyl. air-cooled gasoline engine and has extra 110-volt a.c. power source for operating lights or tools.

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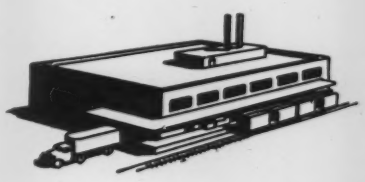

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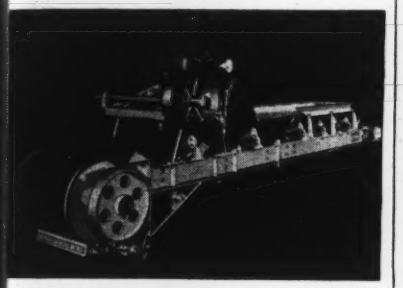
PHILIP CAREY MANUFACTURING CO., CINCINNATI, OHIO—Hot-poured Careylastic joint-sealing compound is mixture of rubbers, asphalts and plasticizers that meets Federal SS-F-336 and state highway specifications. Carey's other roadbuilding products are Elastite expansion joints, bridge plank, and subgrade felt to prevent loss of water from concrete to subgrade.

ELECTRIC STEEL FOUNDRY CO., PORTLAND, ORE.—Manganese steel and hollow arch construction of ESCO dragline buckets—⅜ to 18 yd.—reduces weight, increases strength. Cutting lip has integrally cast tooth horns. Teeth are efficiently placed, with outside ones near edges for wider, easier digging. Featured are buckets and shovel dippers for coal stripping and loading.

GAR WOOD INDUSTRIES, INC., WAYNE DIV., WAYNE, MICH.—New Reel-Rite truck-winch, 20,000-lb. capacity, spools cable in even layers at uniform tension. Cam-operated spooling unit automatically compensates for changed rope diameter, stretch, speed or wear. For garbage collection, Wayne Div. has Load Packer body with low loading hopper and hyraulic packing plate that sweeps and presses refuse into inside of totally inclosed unit.

INSULATION VALUES—A 16-page booklet entitled "The Simplified Physics of Thermal Insulation," is usable as a handbook and in colleges as a text on heat transfer, condensation, vapor, mold, etc. One of the features is a detailed master chart, which shows the K, C, R and U factors of all insulations in all thicknesses, weights, densities, etc. Infra Insulation is an accordian aluminum insulation which absorbs and emits only three per cent of radiant heat, as contrasted with ordinary insulation which absorbs and emits from 65% to 80%. Compactly packaged, the insulation when unpacked and installed, forms four series of low-conductive air compartments as well as four radiant-heat rejecting aluminum surfaces. It is presented as an insulation not only against heat transfer in any direction, but against condensation, vapor, vermin, mold and fire.—*Infra Insulation, 10 Murray St., New York, N. Y.*

CONCRETE PAVING FINISHER—Independent control of traction and screeds is provided by new automotive type transmission. Selective control provides operator with sixteen combinations of screed and traction speeds, claimed to be an advantage in finishing air-entrained concrete. Equipped with 27-hp. engine and with vibratory paving attachment. There is a quick adjustment for crown and the screeds have a telescopic width adjustment. End trucks of unit type are moved over on main structural members for width changes. V-Belt drive with automatic take-up absorbs shock of starting and stopping. Machine has hydraulic screed lifting system.—*Blaw-Knox Co., Pittsburgh, Pa.*



CHANNEL FRAME CONVEYOR—The new "Marco" standardized channel frame conveyor will make for better bulk materials handling. Basic units can be interchanged on varied installations. Terminals and intermediate sections are prefabricated and factory-assembled. Standardization assures proper alignment, easy erection, and dependable operation on the job. The manufacturer offers a complete line of conveyor assemblies which may be used in full or in part for the construction of complete conveyors, or as replacement on existing units.—*E. F. Marsh Engineering Co., 4324 West Clayton Ave., St. Louis, Mo.*

BERM LEVELER — Attachable to standard Huber maintainer for operation along hard-surfaced roads. Hydraulic controls operate blade of maintainer to angle and depth necessary to carry material to pavement edge. Apron, or gathering blade, is bolted to maintainer moldboard. This carries excess material picked up in cutting berm and deposits it in rough or low spots along

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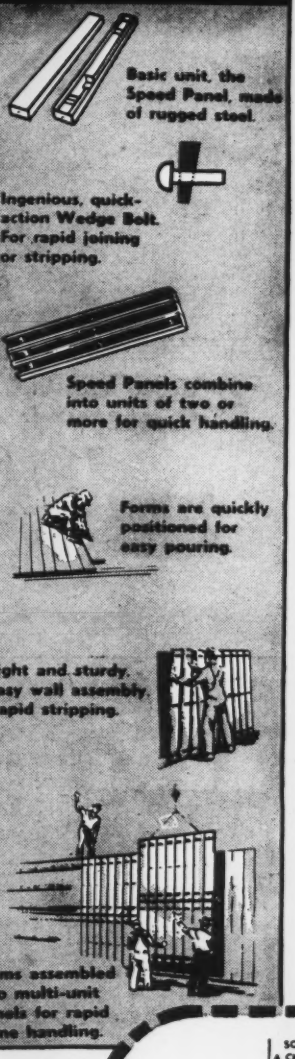
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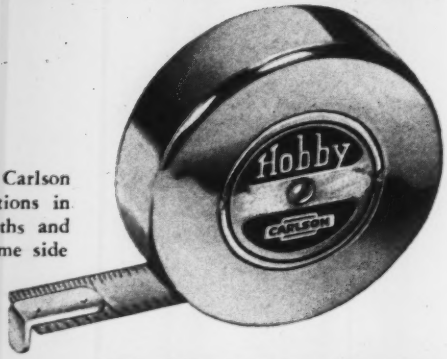

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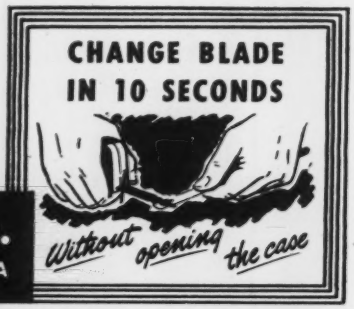

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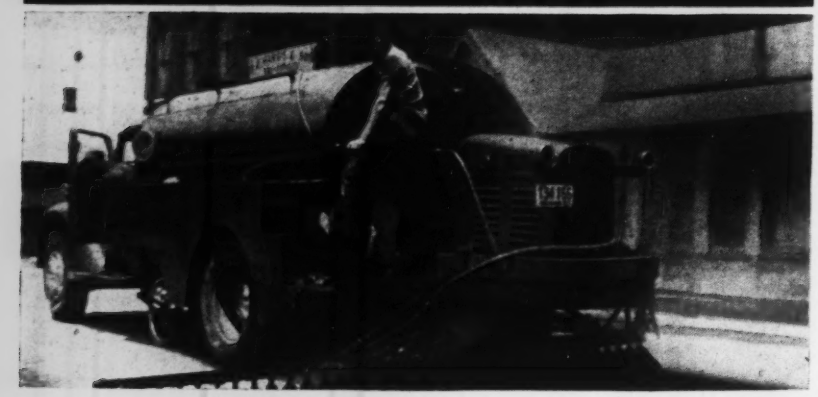

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road edge. Berm leveler, mounted on rear of maintainer, is adjusted by hydraulic control to desired pressure. Road cleaner blade is mounted on rear of leveler attachment to remove small stones and dirt left by berm blade.—*Huber Mfg. Co., Marion, Ohio.*

TRUCK MIXER—Hi Lo machine has stationary mixer drum octagonal in plan. Across drum is main mixer shaft of 5-in. cold rolled seamless tubing. With tapered design of drum, material flows down sides to come into contact with mixing wheels. Discharge gate is sliding type operated by pinions working on rack to produce positive cutoff. The unit is in the 3-yd. mixer classification—*Concrete Transport Mixer Co., 4985 Fyler Ave., St. Louis 9, Mo.*

HEAVY DUTY TRUCK—New model in line of 4- and 6-wheel drive trucks is rated at 33,000 lb. gross vehicle weight. Model ZU has all-steel cab to provide 30 percent greater visibility and increased driver comfort. Frame is 10x3x½-in. heat treated channel steel with welded and reinforced front cross member for strength. Front and rear axles feature 17-in. spiral bevel ring gears and pinions for strength and quietness. Truck has constant-mesh transmission with helical gears and easy sliding jaw clutches for easy shifting and quiet operation. Engine develops 188 hp. at 2,600 rpm. governed speed and 460 ft.-lb of torque at 1,000 rpm. It is recommended by maker for highway maintenance and heavy duty snow removal and for construction haulage.—*Four Wheel Drive Auto Co., Clintonville, Wis.*

LETTERING INSTRUMENT — Varigraph is small mechanical device for reproducing many sizes of letters from a single template directly in ink or pencil. Letters are reproduced in any desired width combined with any desired height between .075 and .750 in. Letter width and height are controlled by positioning two knobs. Device rests directly on surface being lettered and slides against any straight edge in being moved from one letter position to the next. In reproducing a letter a finger-operated point follows the letter grooves in the template. A wide range of lettering template styles is available.—*Varigraph Co., Inc., Lincoln 3, Neb.*

FOUR-WHEEL SCRAPER—Cable-controlled unit of 7.6 cu.yd. heaped capacity is designed for use with 55-hp. tractor. Model 508 takes a deep cut 12 in. below tires and cascades earth into bowl which is of pivoted type. Specifications include: over-all width, 8 ft. 10 in.; wheel base, 14 ft. 6 in.; over-all length including drawbar, 23 ft. 6 in.; bowl width inside, 7 ft. 6 in.; depth of spread

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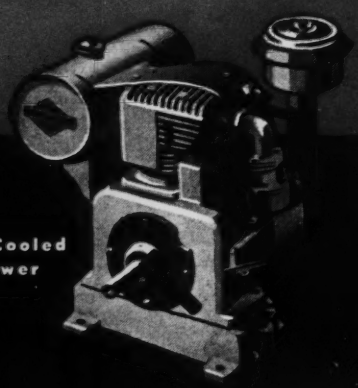

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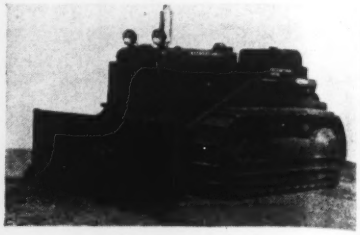
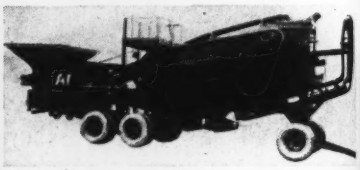
4 CYCLE BRIGGS & STRATTON GASOLINE ENGINES

Attend WISCONSIN CENTENNIAL EXPOSITION Milwaukee August 7-29

above tires, 18 in.; bowl clearance raised for hauling, 18 in.; apron opening, 36 in.; weight, scraper only, 10,200 lb.—*Gar Wood Industries, Inc., Wayne, Mich.*



INSIDE-MOUNTED DOZER — Inside mount removes dozer stresses from track and engine frames and reduces wear on track rails, wheels and idlers. Operated by front-mounted hydraulic pump, leaving rear of tractor free for cable control units, hydraulic cylinders act directly on dozer arms. Has high lift of 48 in. for extra leverage when clearing trees and drops to 12 in. below ground. Cutting edge width is 7 ft. 11¾ in. Bowl is 36 in. high. Total length of unit is 13 ft. 6 in. and weight is 4,350 lb. Radiator guard has hinged face-plate for easy radiator cleaning. Equipment has accurate tilting and leveling adjustment.—*American Tractor Equipment Corp., 9131 San Leandro Boulevard, Oakland 3, Calif.*



PORTABLE GRAVEL PLANT— Recommended for quick, short job hops where material is required in a hurry. Total weight, less power unit, is 40,900 lb., travel length, 41 ft., and height, 12 ft. 9 in. Plant is equipped with six sets of dual 9 x 20 pneumatic tires. A 7-ft. hopper equipped with mechanical feeder takes feed at rear end of plant while processed material is delivered from front end. Equipment includes jaw crusher, a 24 x 16-in. roll crusher and a 3 x 8-ft. 2½-in. deck vibrating screen and a sand screen. Drive is from power unit on plant or from an optional drive through power take-off on a tractor.—*Pioneer Engineering Works, Minneapolis 13, Minn.*

NEW BUILDING INSULATION—An insulation that reflects radiant heat, besides blocking heat transfer by conduction and convection, is announced. Two noncorroding reflective, metallic

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Integrity BEGINS HERE

. . . ***Integrity*** through every phase of engineering, estimating and planning for tomorrow's modern bridges, buildings, highways and plants.

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. . . ***Integrity*** in the shop—each man long skilled in *product perfection* takes personal pride in doing a good job *better*.

. . . and ends here

When the job is completed—ready to turn over to the owners—the time-proven *Integrity* of the Fort Pitt Bridge organization will have added much to the trouble-free, on-time erection.

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"SOME BIG CONSTRUCTION JOB GOING ON DOWN THERE"

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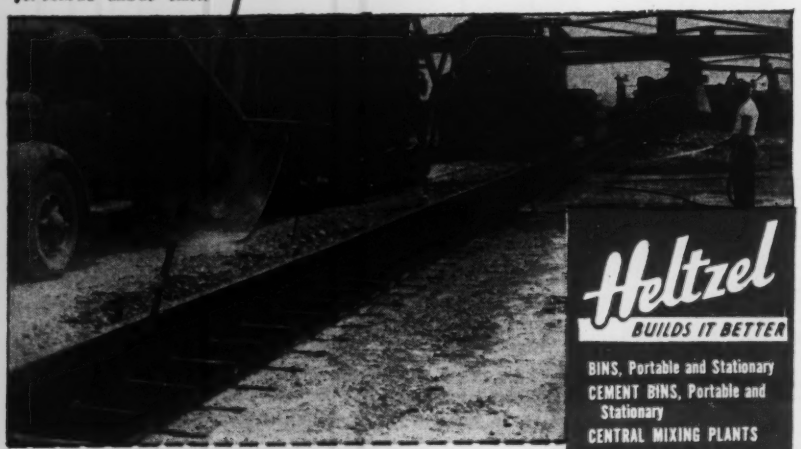
HELTZEL STEEL FORMS

Airport, highway, sidewalk, curb and gutter, or whatever job it might be, there are sure to be Heltzel Steel Forms in the picture. You depend on Heltzel because their concentrated engineering has worked every detail to practical purpose. Each exclusive feature added has eliminated another problem for you.

Heltzel Standard 1/4' Form

The same practical engineering that designed the special dual duty forms for the Patterson Field job is found in every Heltzel Steel Form. The standard form (illustrated above) is built to last, handle easily, and produce a better job. Moved from job to job, year in and year out, they set quickly, interlock smoothly, and strip away easily. They stay rigid because THE SINGLE WEDGE POCKET HOLDS STAKES FIRM — they can't vibrate loose.

Special Heltzel dual duty forms at Patterson Field carried the heaviest construction equipment ever supported by any forms. The same set of forms were used for both 21' and 25' slabs.



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- FINISHING TOOLS FOR CONCRETE ROADS

Heltzel Steel Form & Iron Company, Warren, Ohio

Send me the following:

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(Type of construction usually engaged in)

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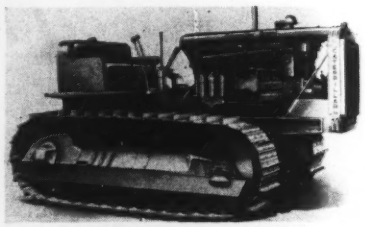
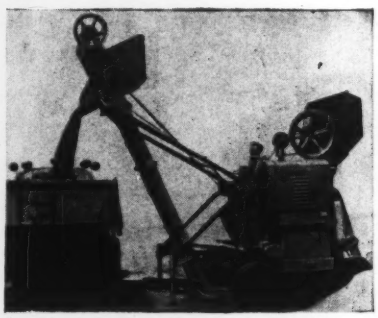
membranes completely enclose a fluffy fiber blanket, whose millions of dead air spaces provide an effective barrier to heat transfer. The reflective surfaces will not oxidize or corrode and are not subject to electrolysis.—*The Gilman Bros. Co., Gilman, Conn.*



DIESEL TRACTOR—New track-type unit of 130 drawbar horsepower features five-speed constant-mesh transmission and three reverse speeds. Recommended for bulldozing, scraper loading and hauling. Separate gear-type oil pump, providing pressure lubrication for bearings and an oil spray over the gear, is provided for the new transmission. Powerful lightweight master clutch with large diameter brake reduces inertia for faster shifting. New drum-type front idler strengthens the rim. Forward travel speeds range from 1.7 to 4.8 mph. and reverse speeds from 2.2 to 3.7 mph. Engine is four-cycle, water-cooled, six cylinder diesel unit. Overall length is 15 ft. 3 in. Gage, center to center tracks, is 78 in. Starting is done with independent two-cylinder vertical gasoline engine.—*Caterpillar Tractor Co., Peoria, Ill.*



FOR DISCHARGING BITUMINOUS MIX—Special tower attachment is adaptable to either the 10 or 14-cu. ft. Kwik-Mix bituminous mixer. Loads bituminous material from ground level mixer into trucks or for stockpiling. Discharge height is from 7¾ to 8¾ ft. Operated by hoist powered by mixer motor. Loader is fully controlled by single level on operator's platform.—*Koehring Co., 3026 W. Concordia Ave., Milwaukee 10, Wis.*

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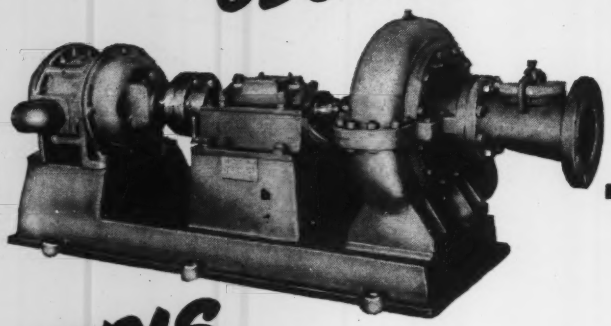

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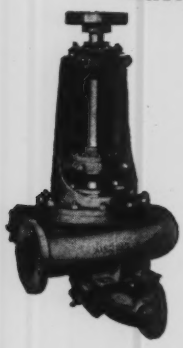
Specially designed to withstand tough operating conditions in any sewage plant.

Despite the severe operating conditions which occur in some sewage plants, the Morris Pumps continue to function dependably, efficiently and economically.

Morris Pumps will handle long, stringy, fibrous materials. Extensive experience in handling mixtures containing abrasive solids enables Morris to design for moderate quantities of grit, without undue impairment. Operation under abnormal conditions such as these prove unquestionably the rugged, superior construction of Morris Pumps.

Morris Pumps are Easily Installed... Easily Maintained... Easily Dismantled



Both the casing and the suction nozzle have hand holes . . . and the construction of the pump permits easy dismantling.

The castings are heavy. And the pumps are mechanically and hydraulically designed for greater resistance to abrasion.

Both the horizontal and vertical Morris Pumps are available in sizes ranging from 3" to 20" and adaptable to all types of drives.

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MORRIS Centrifugal Pumps

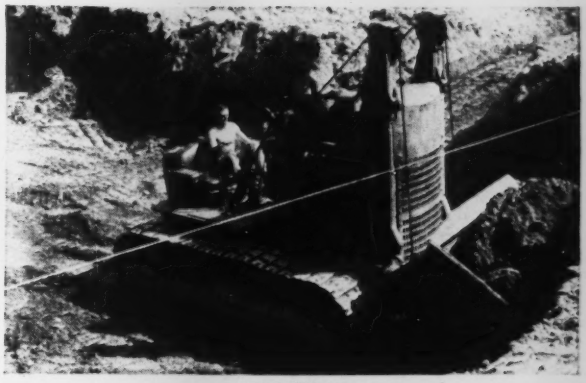
CORRUGATED ALUMINUM ROOFING—For use as roofing and siding on industrial buildings of every type new 0.032-in. thick corrugated aluminum sheet weighs only 56 lb. per sq. (100 sq. ft.). Corrugation depth is 7/8 in. and pitch is 2.666 in. Deep corrugations strengthen sheet and provide sufficient rigidity for application directly over purlins. Maximum safe recommended loads in pounds per square foot range from 35 for 72-in. span to 106 for 42-in. span. Several sheet sizes are available. For use as siding the material comes in a single width of 33¾ in., and in lengths ranging from 5 to 12 ft. in multiples of 1 ft. For use as roofing the sheets are supplied in a single width of 35 in. and in the same range of lengths as the siding, (5-12 ft.). Accessories for use with this aluminum roofing and siding include purlin straps, closure strips, rivets, sealing washers, aluminum nails, boilts and screws. Advantages claimed for the aluminum roofing and siding are immunity to rust, rot, and mildew, high strength and long life and resistance to chemical fumes. Aluminum sheets reflect as high as 95 per cent of sun's radiant heat—*Reynolds Metals Co., 2500 S. Third St., Louisville, Ky.*

AIR HOSE FOR SMALL TOOLS—Weighs less than half as much as, and is stronger than ordinary hose. Flexible as a lamp cord because of light weight. In ¼ in. size hose weighs only 8.8 lb. per 100 ft. Oilproof inside and out. Designed for working pressures up to 250 psi. Cover will not tear or snag easily.—*B. F. Goodrich Co., Akron, Ohio.*

RUBBER-TIRED QUARRY TRAILER—Equipped with large single low pressure tires for use with Caterpillar DW10 tractor, new rugged unit is designed for

TRAXCAVATORS

ARE THE COMPLETE ANSWERS TO YOUR EARTH MOVING AND MATERIAL HANDLING PROBLEMS



DIGS

LOADS

GRADES

CARRIES

See these machines at the Road Show and get the complete answers to your earth moving and material handling problems. Put a TRAXCAVATOR on any job — and watch its versatility, speed and power turn tough, troublesome jobs into profitable ones in short order.

That's why contractors who demand efficient performance and public officials who must stretch tax dollars make TRAXCAVATORS their unanimous choice on all kinds of jobs. They know that you can't beat TRAXCAVATORS for low-cost digging, loading, carrying, grading or bulk material handling.

TRAXCAVATORS are the only tractor excavators built in a complete range of sizes — with bucket capacities from ½ to 4 cubic yards — A SIZE FOR EVERY JOB AND PURPOSE. Contact your nearest TRACKSON-"Caterpillar" dealer or write to TRACKSON COMPANY, Dept. EN-78, Milwaukee 1, Wisconsin.

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Spaces 3208 to 3805

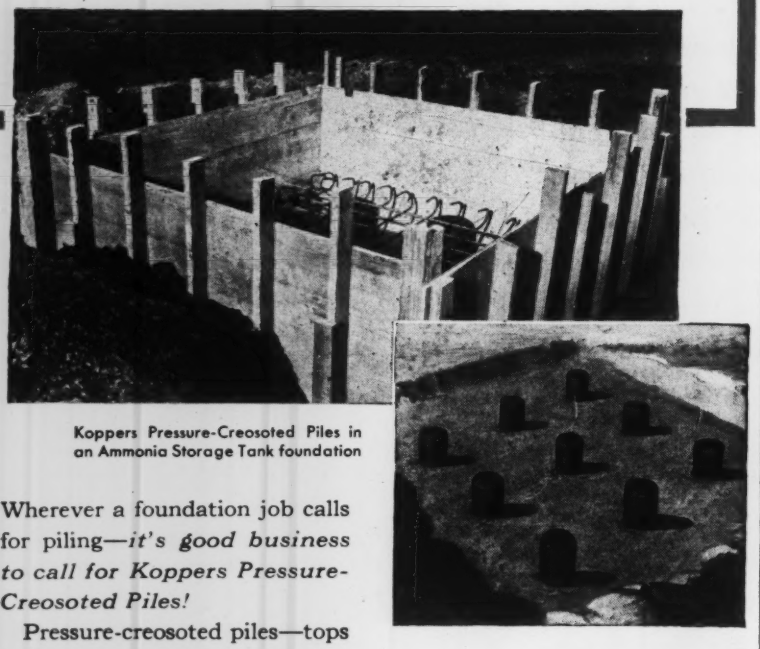
SOUTH CONCOURSE

PERMANENT AND ECONOMICAL

from the bottom up, with

KOPPERS PRESSURE-CREOSOTED

PILES



Koppers Pressure-Creosoted Piles in an Ammonia Storage Tank foundation

Wherever a foundation job calls for piling—*it's good business to call for Koppers Pressure-Creosoted Piles!*

Pressure-creosoted piles—tops soaked in creosote and capped in concrete—are included in modern building codes for permanent foundations. Penetration of creosote protects the wood against decay and termites. The surrounding earth smothers evaporation of the creosote.

Creosoted piles, pulled after nearly 50 years use, were "reeking with creosote."

Theoretical estimates of the life expectancy of creosoted piles run into many hundreds of years.

Koppers Pressure-Creosoted Piles have an earned reputation for economy and permanence.

Of equal importance—Koppers Treating Plants have an earned reputation for keeping delivery promises.

KOPPERS

PRESSURE-TREATED WOOD

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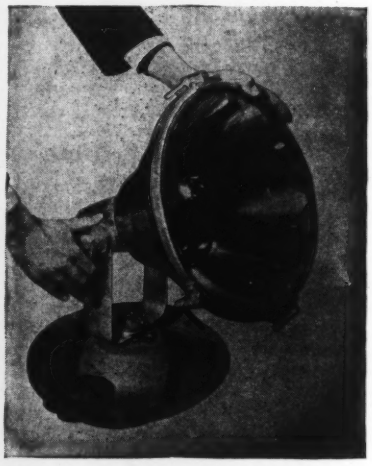
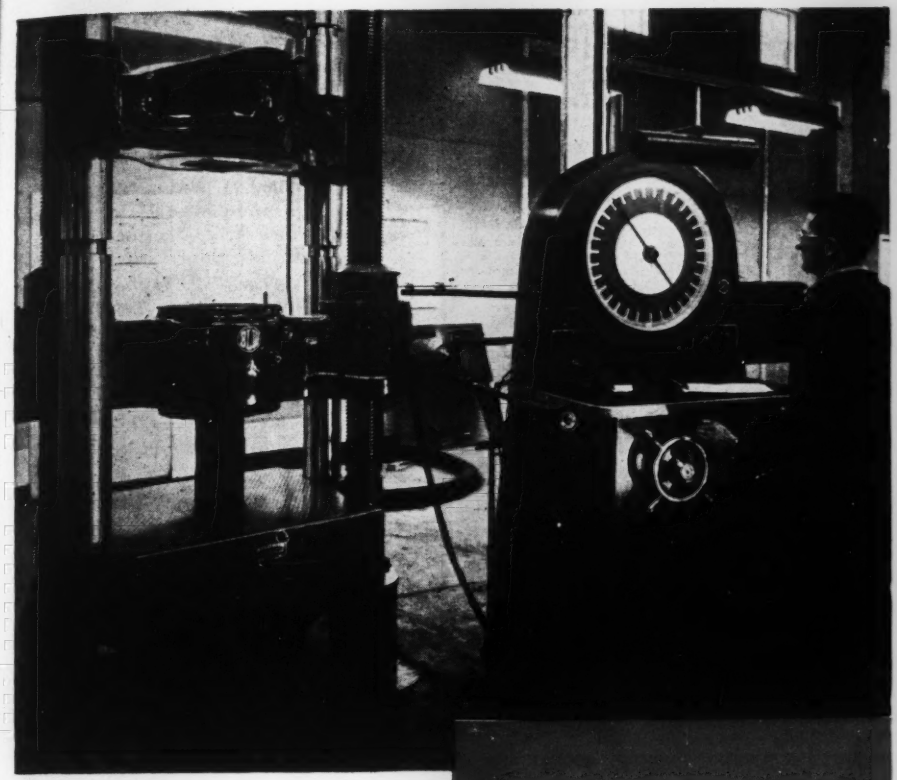
tough rock-moving jobs. Single low pressure tires reduce rolling resistance to facilitate faster hauling of heavier loads. Tires are interchangeable with Caterpillar tractor tires.—*Athey Products Corp., 5631 West 65th St., Chicago 38, Ill.*

ADJUSTABLE SPREADER — Wall forms are spread and held in line by the Williams Adjustable Form Aligner, shown as part of an assembly of Williams form hardware. The spreader is made up of two parallel bars which may be clamped in any position on the footing. Before form erection the spreaders are placed on the threaded projection of anchor-bolts placed in the footing concrete. Chalk lines are snapped for the interior sheathing surface position and the spreader ends are moved to the chalk lines.—*Williams Form Engineering Corp., Box 925, Madison Square Station, Grand Rapids 7, Mich.*



FLOODLIGHTS—Two new general purpose floodlights for small area lighting are rated at 300-500 watts and 750-1000 watts respectively. Aluminum reflector insures high beam efficiency. Locking handle on elevation adjustment eliminates need of using wrenches. Lights are provided with portable base as well as slip fitter and pipe clamp mountings.—*General Electric Co., Schenectady 5, N. Y.*

PIPE COATING—A new protective coating has exceptional resistance to electrolysis and corrosion, the electrochemical reaction which is so costly to many pipe installations. It also has great shock impact resistance. Other advantages claimed are: great ductility, high flash and fire point, and it is not being affected by alkalis and soil acids.—*National Petroleum Sales, Inc., 315 West 9th St., Los Angeles, Calif.*



ABOVE: Calibrating Testing Equipment at the Wharton Laboratory

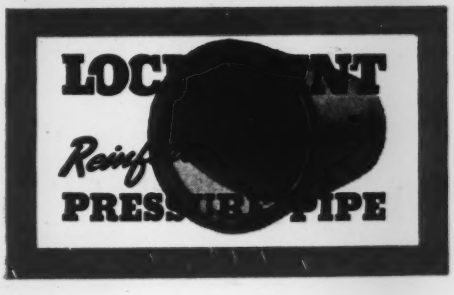
ABOVE LEFT: Testing Concrete Cylinder for Compressive Strength

CONSTANT TESTING assures top quality

All materials used in the manufacture of Lock Joint Prestressed Concrete Cylinder Pipe are carefully tested to assure their uniformly high quality.

In Lock Joint's Laboratory at Wharton, New Jersey, accurately calibrated testing equipment checks the physical properties of all materials which constitute the finished product and test the physical characteristics of the completed pipe.

This constant check on all materials used in Lock Joint Pressure Pipe assures the top quality and long, useful service ot the finished product.



SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

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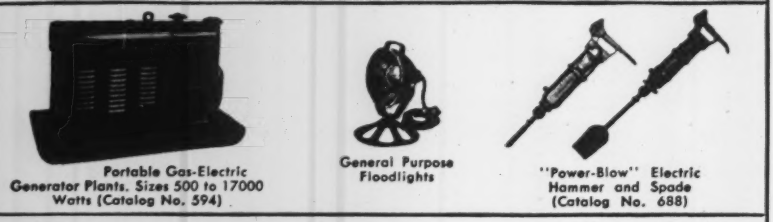
Gas or Electric Concrete Vibrators (Catalog No. 689)

Hand Tools for operating from all Master Vibrators and BIG-3 (Catalog No. 683)

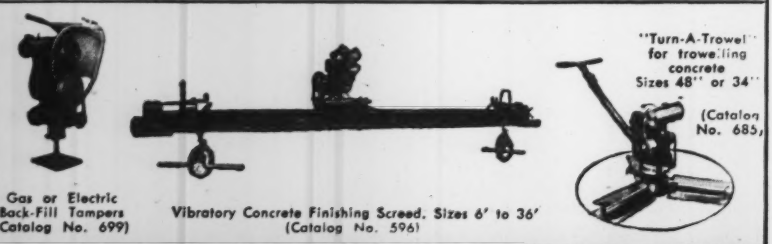
BIG-3 for Generation, Tool Operation and Concrete Vibration (Catalog No. 687)



Portable Gas-Electric Generator Plants. Sizes 500 to 17000 Watts (Catalog No. 594)

General Purpose Floodlights

"Power-Blow" Electric Hammer and Spade (Catalog No. 688)



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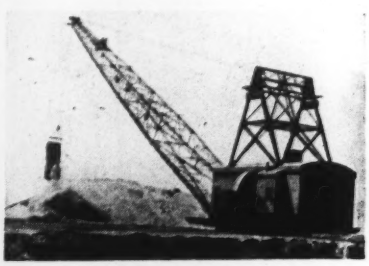
But we do say this, without fear of contradiction — repeated erasures and redrawings made on Holliston MICRO-WEAVE Tracing Cloth leave a *minimum* of feathering.

Exaggeration wins no customers. Modest claims — maximum uniform transparency, ready erasability, cleaner sharper blueprints, no pin holes or thick threads — are made for both MICRO-WEAVE Pencil and Ink Tracing Cloth. These qualities can easily be verified and proved on your own drawing board. Write for generous sample. Test and be convinced.

THE HOLLISTON MILLS, INC.

CHICAGO NORWOOD, MASS. NEW YORK

LOW-COST STONE CRUSHER An experimental model of a super-size double impeller impact breaker has been constructed. The manufacturer expects that the machine will handle any stone fitting into a 2-yd. shovel. It is designed to produce aggregate in minus 8 in. and minus 3½ in. Two impellers which strike the stone in midair as it falls into the breaking chamber will each weight 13,400 lb., with bars. Each impeller will have three pairs of 500-lb. bars. Rotating in opposite directions, the impellers will be capable of a maximum speed of 785 rpm. It is estimated that each impeller will require a separate power unit of from 100 h. p. up.—*New Holland Machine Co., New Holland, Pa.*



WALKING DRAGLINE—Designed for big yardages, machine swings 8-10-cu. yd. bucket from 200-165-ft. boom. Powered by heavy-duty diesel engine, machine can move material 407 ft. without throwing bucket. Hoisting and lowering are through air-operated clutches and brakes; swing machinery is under Ward-Leonard variable-voltage control. Rolling cam walking action permits walking in any direction to positions most effective for digging. Large area base and shoes and proper weight distribution make possible walking and working on soft ground. Machine is designated as Model 450-W. —*Bucyrus-Erie Co., South Milwaukee, Wis.*

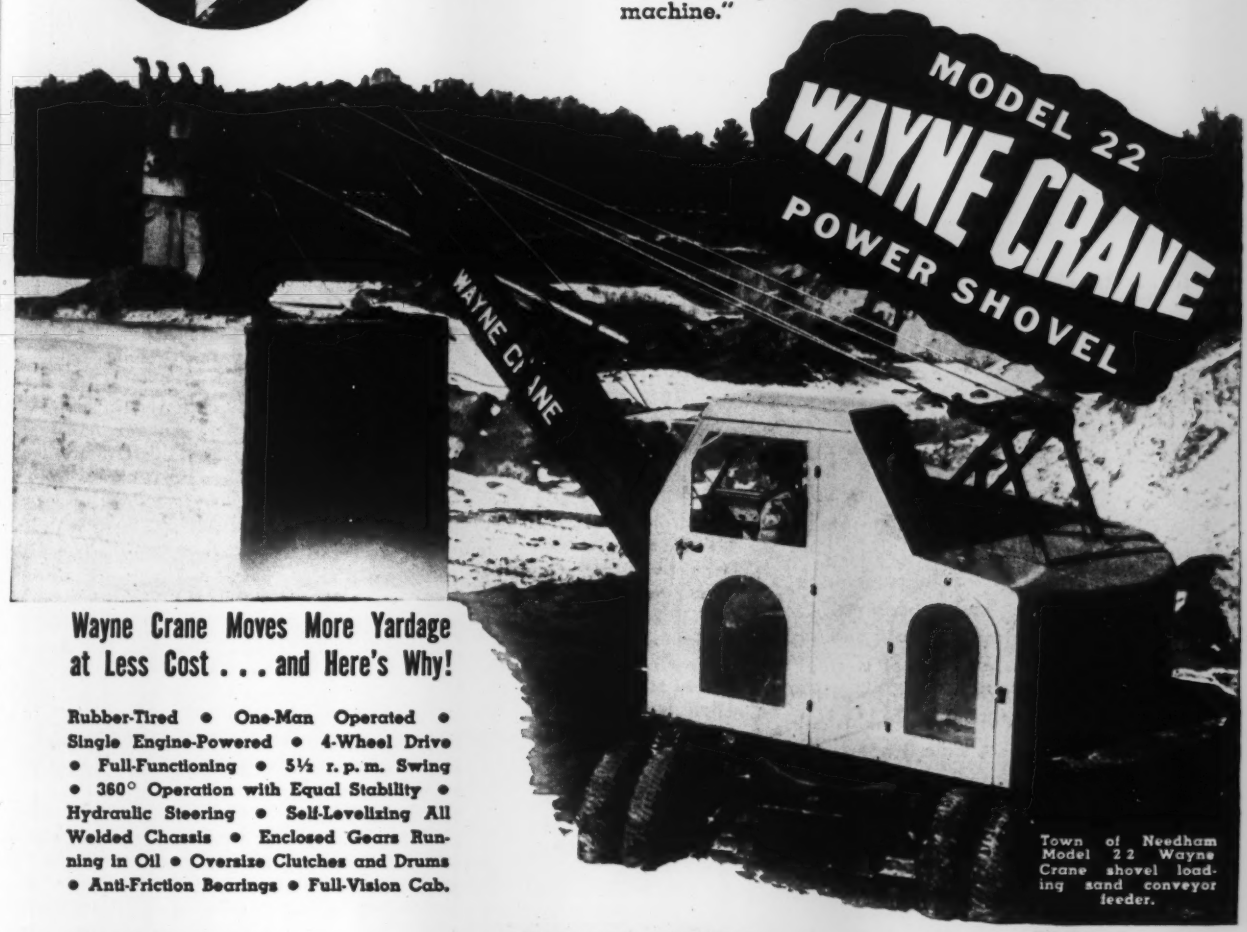
HAND-HELD PENCIL SHARPENER —Small tool with hollow-ground cutting blade mounted in plastic case is called "Hold-'n' Hand" pointer pencil sharpener. Pencil is sharpened by inserting in hole in case and twisting it as case is held in other hand. A container catches the pencil shavings. "Stop" device indicates by feel when pencil is correctly pointed, eliminating wasteful chewing up of lead. A turn of a ball-bearing indicator tap makes possible a point for every purpose including standard points, draftsmen's professional long-lead blunt or long-lead sharp points.—*Triple "E" Products Co., 4517 Olive St., St. Louis 8, Mo.*

"We Are Convinced . . .

that Wayne Crane has a greater use than any other type machine available . . ." says Lester C. Hollis, Superintendent, Needham, Mass., Public Works Department.

LESTER C. HOLLIS

"We are convinced that Wayne Crane has a greater use than any other type machine available, and it has served a much needed purpose as a cost-reducing factor to offset the rising costs and labor shortage in our Town. Our Wayne Crane performs equally well as a shovel or trench hoe on difficult jobs, which previously were not considered practical even for a rubber-mounted machine."



Town of Needham Model 22 Wayne Crane shovel loading sand conveyor feeder.

Wayne Crane Moves More Yardage at Less Cost . . . and Here's Why!

Rubber-Tired • One-Man Operated • Single Engine-Powered • 4-Wheel Drive • Full-Functioning • 5½ r. p. m. Swing • 360° Operation with Equal Stability • Hydraulic Steering • Self-Levelizing All Welded Chassis • Enclosed Gears Running in Oil • Oversize Clutches and Drums • Anti-Friction Bearings • Full-Vision Cab.

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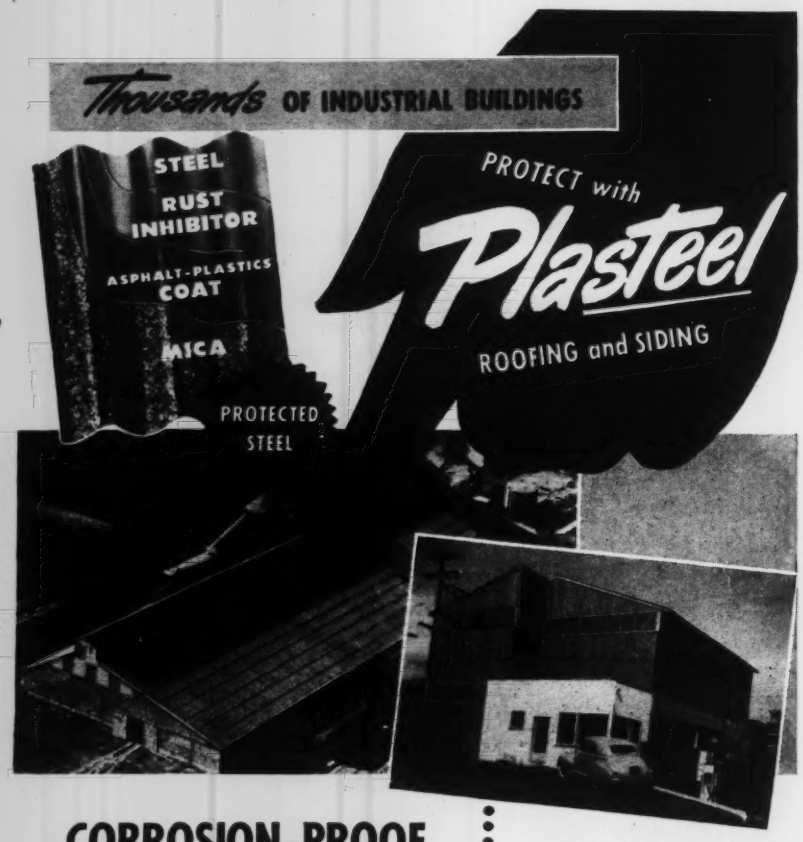

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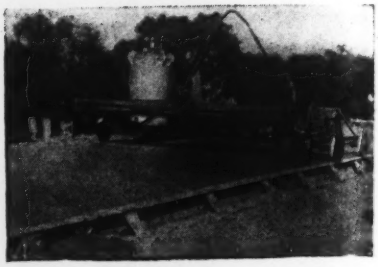
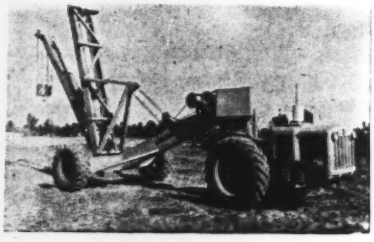
LIGHTWEIGHT ROAD GRADER—Model 30 power maintainer is hydraulically controlled from operator's seat and features attachment which includes leaning front wheels, power broom, snow plow, bulldozer blade and scarifier. Operates a five forward speeds ranging from 2.5 to 15.7 mph. and one reverse speed. Blade clearance is 12 in. and maximum blade pressure is approximately 5,000 lb. Equipment is built around a modified International power unit of 31.5 hp.—*Meili-Blumberg Corp., New Holstein, Wis.*



AUTOMATIC SPRAY MACHINE—Single-nozzle machine, riding on forms, applies membrane curing material to concrete pavement, is fully automatic in operation and includes remote control start and stop attachment. Double sprays each square foot of concrete. External-mix type spray gun does not foul or drip. Machine equipped with 60-gal. constantly agitated pressure tank is available in widths from 10 to 25 ft.—*Flex-Plane Co., Warren, Ohio.*



MOBILE CRANE—New 7-ton lift-and-carry unit has 3-way positive electric control for pin-point spotting, lifting and placing load. Motive power for unit is a roadster-type Tournapull. Elevator track is adjustable to any angle from horizontal to 14 deg. forward of vertical, so that heavy loads can be picked up and positioned over rear axle for carrying. Electric motors are fed by high capacity generator mounted in line with engine. Positive braking can be had at any height or reach and with any lift. Crane is a one-man operated machine equipped with finger-tip buttons. Crane will lift rated capacity without use of outriggers or counterweights, and carry loads over smooth

MILES AHEAD IN FAST LOW-COST HIGHWAY MAINTENANCE!

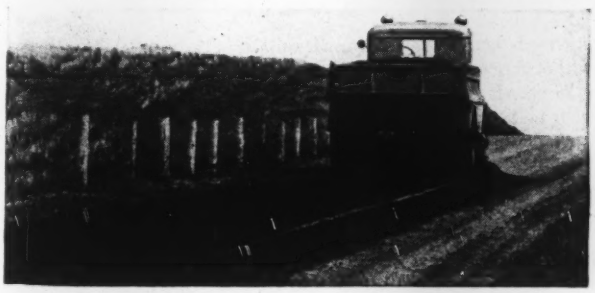
ALL the features you want and need are yours in the FWD Model HG Maintainer.

- Five-forward-speed transmission to give you the speed ranges required for road maintaining operations.
- Hydraulically controlled under-body blade that cuts material off the high spots and rolls it into the low spots. Blades and grades faster.
- Greater under-body clearance — no need to remove blade, just move it up out of position — and you are on your way at road speeds up to 40 miles per hour.
- The comfort and convenience of a modern driver's cab makes the FWD "HG" an all-weather, all-season unit of equipment.

You can go to and from the job faster — maintain more miles of road per day — cut maintenance costs up to 30% to 50%. The FWD "HG" is the Maintainer for many jobs — equipment that has no idle season.

For complete information see your nearest FWD distributor.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
Canadian Factory: KITCHENER, ONTARIO



America's Foremost Heavy-Duty Truck

Worthington-Ransome Blue Brute Distributors

See ad on page 229 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Ragsdale Mach. Co., Inc.
Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

Fla., Miami, Allied Equip. Inc.
Jacksonville, Ogden Equip. Co.
Orlando, Highway Equipment and Supply Co.
Tampa, Epperson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp.

Kansas, Topeka, M. H. Salisbury Co.
Ky., Harlan, Croushorn Equip. & Supply Co.
Louisville, Williams Tractor Co.

Maine, South Portland, N. A. Burditt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co. Inc.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Phillippi Murphy Equip. Co.
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
Montana, Billings, Seitz Machinery Co., Inc.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co.
N. Hampshire, Manchester, R. C. Hazelton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Roswell, Smith Machy. Co.
N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
N. Y., Syracuse, Mid States Contr. Equip. Co., Inc.
N. C., High Point, Smith Equip. Co.
N. D., Fargo, Smith Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilgore Machy. Co.
Okla., Oklahoma City, Tattan-Douglas Equip. Co.
Oregon, Portland, Andersen Machinery

Pa., Bradford, Bradford Supply Co.
Wilkes-Barre, Kramlinger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, San Antonio Machy. & Supply Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highway Machy. and Supply Co.

W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle, Star Machy. Co.
Wash., Spokane, Star Machy. Co.
Wash., Yakima, Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

O., Cleveland, H. B. Fuller Equip. Co.
Pa., Pittsburgh, Arrow Supply Company.

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company
La., New Orleans, Wm. F. Surgi Equip. Co.
Md., Baltimore, D. C. Elphinstone, Inc.
O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.
Pa., Pittsburgh, Atlas Equip. Co.
Texas, El Paso, Equip. Supply Co.
Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Blue Brute Engines

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

or rough surfaces. Large pneumatic tires cushion load. Turning radius of EC-7 Model is 20-ft. area. Forward wheels are steerable and tractive. Crane offers minimum headroom of 8 ft. 9 in., maximum lift of 29 ft. 6 in., and maximum reached behind center line of crane wheels of 31 ft. Travel speed ranges up to 28 mph.—*Tournalayer Div. of R. G. Letourneau, Inc., Longview, Tex.*

DAMPPROOFING COMPOUND—New emulsified mastic compound dampproofs exterior concrete and masonry surfaces below grade. Product called "Hydrocide 700" is specially designed for application to damp surfaces to which it will adhere firmly. Produces elastic, membrane-like coating resistant to penetration of moisture from soil. It contains specially refined asphalt reinforced with long-fibered asbestos. Coverage is 100 sq. ft. per 4-5 gal., depending on character of surface. Requires no heating or thinning.—*L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.*

LOADER AND AUGER—Designed for mounting on Case DAI industrial tractor. Loader of 3/8-yd. struck capacity has dumping height of 8 ft. 6 in. Auger is designed for mounting on rear of tractor. Standard loader bucket is interchangeable with fork lift, angle dozer, coal bucket, wide bucket, and crane hook.—*Construction Products Corp., 4345 East Imperial Highway, Lynwood, Calif.*

CHAIN SAW—Lightweight, one-man unit has 18-in. cutting capacity and is powered by 3½-hp. air cooled Mercury gasoline engine. Has built-in automatic chain lubricator operating under pressure. Fuel system permits operation at top efficiency even when saw is used upside down. Starting is made easy by self-rewinding Magnapull starter which is built into engine. Control is concentrated in pistol grip handle. Throttle is at operator's finger tip with fuel mixture control lever nearby. Priming valve is provided for easy starting in extreme cold.—*Henry Disston & Sons, Inc., Philadelphia, Pa.*

FLEXIBLE STEEL FORM IMPROVEMENT—New development supports face forms by means of overhead hangers permitting concrete curb construction of any length without breaks or scoring of concrete. There is ample clearance beneath overhead hanger for hand finishing. Position of hangers on forms is adjustable to allow for obstacle interference.—*Heltzel Steel Form & Iron Co., Warren, Ohio.*

HOUSE FLASHING SYSTEM—A neatly-packaged house flashing system is now being produced. It includes 10 sheets of 31-gauge tempered rust-proof copper, precut to 18 x 48 in., and 200 hardware bronze nails. The new product is especially adapted for use in low-cost residential building. Two packages are enough to flash adequately the average low-cost 5 or 6-room house.—*Revere Copper and Brass, Inc., 230 Park Ave., New York 17, N. Y.*

POWER DRIVE PIPE CUTTER—A new power drive has been developed for operating hand pipe cutters, threaders and reamers. The new unit weighs only 100 lb. Cleanly housed in a case, it has a 3-jaw lathe-type scroll chuck in front and a self-centering workholder in the rear which turns with the pipe. It has sealed-in lubrication and plugs into any 110-a.c. light socket.—*The Ridge Tool Co., Elyria, Ohio.*

ALUMINUM BUILT-UP ROOFING—For new roofs or repairs to old ones, there has been developed an embossed aluminum product which reflects sun heat and thus protects underlayers of asphalt and saturated felt. It does not absorb water and prevents oxidation. It is easily worked and can be rapidly moulded over uneven surfaces and around vents and parapet walls. It is fire-resistant.—*Reynolds Metals Co., 19 East 47th St., New York 17, N. Y.*

AIR MOTORS—Made in two sizes, 9 and 20 hp. as starters for internal combustion engines. Small, compact air motor is keyed or splined to starting mechanism. Engine is cranked in same manner as automobile engine is turned over by electric starter. Motors develop 9 and 20 hp. at 90 psi. air pressure. Overall lengths are 13⅜ in. and 14½ in.—*Ingersoll-Rand Co., Phillipsburg, N. J.*

PIPE COATING—A new protective coating has exceptional resistance to electrolysis and corrosion, the electrochemical reaction which is so costly to many pipe installations. It also has great shock impact resistance. Other advantages claimed are: great ductility, high flash and fire point, and it is not being affected by alkalis and soil acids.—*National Petroleum Sales, Inc., 315 West 9th St., Los Angeles, Calif.*

NEW BUILDING INSULATION—An insulation that reflects radiant heat, besides blocking heat transfer by conduction and convection, is announced. Two noncorroding reflective, metallic membranes completely enclose a fluffy fiber blanket, whose millions of dead air spaces provide an effective barrier to heat transfer. The reflective surfaces will not oxidize or corrode and are not subject to electrolysis.—*The Gilman Bros. Co., Gilman, Conn.*

...AND THE CHOICE WAS 100% BLUE BRUTES!

Two Blue Brute Portable Compressors powering four Blue Brute UMW-40 Wagon Drills, breaking ground for the Franklin D. Roosevelt Veterans' Hospital near Peekskill, N. Y. Part of the All-Blue-Brute equipment used for rock excavation by the Mt. Vernon Contracting Corporation of Mt. Vernon, N. Y., sub-contracting for Merritt, Chapman & Scott of New York City and Fred J. Brotherton of Hackensack, N. J.

When a big-time contractor goes all-out for one make of equipment, it's time to sit up and take notice! That's what happened last summer, when the Mt. Vernon Contracting Corporation was awarded the sub-contract of excavating, grading and remodeling the 383-acre site of the huge, $22,400,000 Franklin D. Roosevelt Veterans' Hospital at Cruger's Park, N. Y.

For rock excavation, the Mt. Vernon Corporation selected Worthington Blue Brutes—*100%*—nine 500′ and two 315′ Blue Brute Portable Compressors, fourteen Blue Brute Wagon Drills and eighteen Blue Brute Hand-Held Rock Drills. Equipment-wise from long experience, Mt. Vernon executives knew they could count on Blue Brutes for top performance *all* day — *every* day — under the toughest going.

On your own jobs, hook up a Blue Brute Compressor with Blue Brute Air Tools and watch a hard-hitting combination start things moving—fast! You'll get new ideas about speed, efficiency and economy — and about the Blue Brute teamwork that gives you a comfortable feeling on every bid.

Your nearby Blue Brute Distributor is ready with complete details about features, capacities, performances, etc. Or write to us direct.

HB-7

KNOW YOUR BLUE BRUTES

Your Blue Brute Distributor will be glad to show you how Worthington-Ransome construction equipment will put your jobs on a profitable basis. His name is listed on Page 228.

RANSOME EQUIPMENT

Pavers, Portable and Stationary Mixers, Truck Mixers, and Accessories.

WORTHINGTON EQUIPMENT

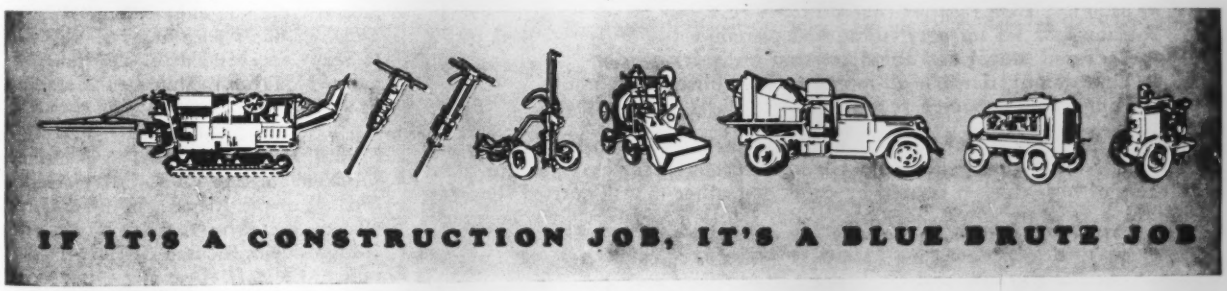
Gasoline and Diesel Driven Portable Compressors, Rock Drills, Air Tools, Self-Priming Centrifugal Pumps and Accessories.

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.

Distributors in all principal cities

BUY BLUE BRUTES



THE *DIXIE* CARRIER keeps water COOL for hours

uses clean *VORTEX CUPS*

Plenty of cool water means plenty more work. The Dixie Portable Water Carrier is especially designed to refresh and invigorate your men on the job. Features include:

- Insulation that keeps water cool for hours
- Stainless steel interior that prevents rust
- Snap-lock lid for easy filling and cleaning
- Recessed faucet and steady stream for quick service
- Lightweight, durable all-metal tank in olive and chrome
- Four gallon capacity

The Dixie Portable Water Carrier* dispenses inexpensive Vortex Cups, which are pleasant to use and leakproof. Clean, disposable Vortex Cups are great preventers of absenteeism caused by colds and other mouth-carried illnesses. Write for booklet on Dixie Portable Water Carrier to Dixie Cup Company, Easton, Pa.

*Also available for flat-bottomed Dixie Cups.

Elections and Activities

Lorenz G. Straub, director of the St. Anthony Falls Hydraulic Laboratory and head of the civil engineering department at the University of Minnesota, has been elected president of the International Association for Hydraulic Structures Research in Stockholm, Sweden. He went to Europe to attend several scientific meetings and to confer with and lecture to groups of European engineers. He went first to Paris where he spoke at the centennial meeting of the French Society of Civil Engineers and before the Association des Ingenieurs-Docteurs de France at the Sorbonne.

At the annual election of the Engineers and Architects Association of Southern California recently, J. N. Robertson was named president and Fred S. Lohman vice-president. Others elected to the board of directors include W. H. Barnes, Frederick Faulkner, Jr., E. J. Shanks, George W. Stosskopf, and Miss Josephine Wheeler. President Robertson and Mr. Faulkner were re-elected from the preceding board; Miss Wheeler is the first woman to be named to the board in its 54 years. The association has a membership of about 2,000.

E. D. Fry, superintendent of the Greenville sewer district has been elected president of the South Carolina Waterworks and Sewerage Association. J. W. Logan was named vice-president, and W. T. Linton of Columbia, secretary-treasurer.

W. Albert Hogle, who organized the Northwest Ohio Drainage Association eleven years ago, has been elected president, succeeding T. K. Priddy, Van Wert County engineer.

Irving M. Footlik, instructor in materials handling engineering, Illinois Institute of Technology, Chicago, and a member of the engineering staff of Ekco Products Co., has been elected to serve as president of the newly-organized Midwest Materials Handling Society.

Paul J. Pakurar has been elected president of the Technical Societies Council of the Niagara frontier. Other officers elected in Buffalo, N. Y., are: vice-president, Richard G. Harper; secretary, Clair O. Dean, and treasurer,

Carlos E. Harrington. Edward J. Nunan is retiring president.

Victor Kerr, Painesville, Ohio, has been elected president of the Northeast chapter of the Ohio Society of Professional Engineers, with Frank W. Shelton, Jr., vice-president; and Richard M. Plummer, secretary-treasurer.

Ohio Society of Professional Engineers has elected the following officers: John J. Heier, Columbus, railroad crossing engineer with the Bureau of Bridges and Railroad Crossings of the Ohio Highway Department, president; Robert E. Allen, chief engineer, Univis Lens Co., Dayton, vice-president; George W. Clark, instructor in civil engineering, Ohio University, Athens, vice-president; Harvey R. Hawgood, Cleveland, patent attorney, vice-president; Raymond A. Freese, Cleveland, district manager, Armco Drainage and Metal Products Co., secretary; Robert R. Litehiser, Columbus, chief engineer, state highway testing and research laboratory, treasurer; and Allison C. Neff, Middletown, vice-president of Armco Drainage and Metal Products Co., N. S. P. E. director.

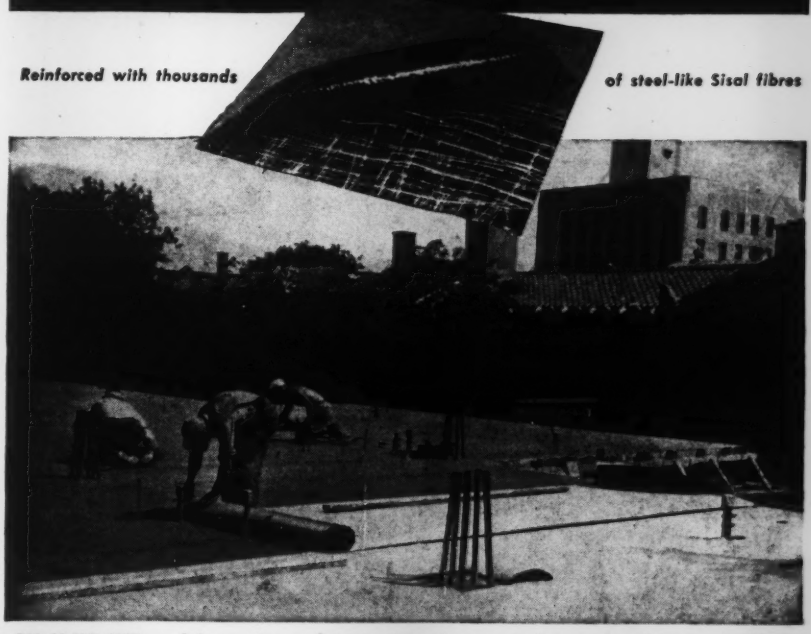
The officers of the Society of Construction Superintendents, Inc., New York City, are: President, Augustus B. Fleck, safety engineer for the Mutual Life Insurance Co.; vice-president, George Martin, project superintendent for the Large Scale Housing Corp.; secretary, Sidney Millsten, general manager of Schnurmacher Bros., Inc.; and sergeant-at-arms, Joe Jablon, construction superintendent for Hart-Jay Construction Corp.

The Texas Good Roads Association has re-elected officers as follows: R. J. Potts of Harlingen, president; Ike Ashburn of Austin, executive vice-president; Joe Leonard of Gainesville, N. B. Zachry of San Antonio, and T. C. Jones of Fort Worth, first, second and third vice-presidents, respectively; and E. P. Gravens of Austin, secretary and treasurer.

G. E. Treloar of Sarnia, Ont., has been elected president at the 18th Annual Convention of the Canadian Institute of Steel Construction and R. C. Ulanning was named general manager and chief engineer.

Lewis J. Sforzini has been elected president of the Monroe County, N. Y., Chapter of Professional Engineers. Other officers are: Vice-president, John Lewis; treasurer, Hiram W. Barnes; secretary, L. Dilwin Jackson. New directors are A. Kohler, A. B. Boehmer and E. K. Haas.

MAXIMUM PROTECTION
MINIMUM COST
with
SISALKRAFT



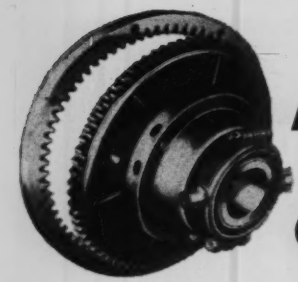
SISALKRAFT used for curing and protection of concrete floors of multi-story building

CLEAN and DUST-FREE FLOORS
AT REDUCED COST!

SISALKRAFT is so strong it furnishes positive protection from debris and construction stains, and prevents marring. It also affords dependable frost-protection. It is so light-weight, it can be rolled into place easily and be removed quickly. Economical . . . can be used many times over.

The SISALKRAFT Method of curing and protection is used not only on buildings of concrete construction, but also, in a big way, on concrete highways. This modern method is automatic . . . no watching, no sprinkling, no other covering. The SISALKRAFT Method is a "natural" for you on single-story and multi-story jobs . . . also for driveways, sidewalks and roads. For complete data write Dept. ENR.

SK
The SISALKRAFT Co., 205 WEST WACKER DRIVE, CHICAGO 6, ILL.
Manufacturers of . . .
SISALKRAFT • SISALATION • COPPER ARMORED SISALKRAFT • FIBREEN • SISALTAPE



Model CL Clutch

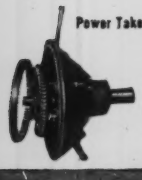
A Smooth CLUTCH... FOR A Rough JOB

Rugged jobs that demand an easy-to-engage, smooth-running clutch . . . such as control of forward and reverse movement of a 12-ton roller . . . are jobs for Twin Disc Friction Clutches.

Twin Disc Friction Clutches take hold smoothly without grabbing . . . grip firmly without slipping when fully engaged. This positive action is made possible by use of wide friction surfaces, the highest grade of friction material, and moving parts designed for accuracy of balance.

Twin Disc Friction Clutches are available in one, two and three-plate construction. Sizes range from 5.5″ up to 42″, with capacities from 12 hp to 875 hp. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Forward and reverse movement of this 12-ton Galion three-wheel road roller is accomplished through two Twin Disc double-plate friction clutches. The master clutch on this model is also Twin Disc.



TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

Manufacturers' Publications

PORTABLE ELECTRIC TOOLS—In a 20-page illustrated catalog a section on portable electric tools lists saws, sanders, edgers and radial saws for use in woodworking, building, construction and allied industries. Specifications and applications are given.—*Porter-Cable Machine Co., 1714 North Salina St., Syracuse 8, N. Y.*

STEEL WATER TANK PROTECTION—A functional specification sheet explains cathodic protection for the mitigation of rust and corrosion damage in water works, sewage treatment and other submerged or buried metal structures.—*Electro Rust-proofing Corp., 1 Main St., Belleville 9, N. J.*

BATCH-TYPE MIXING PLANTS—A 36-page catalog describes the Cedar Rapids line of batch-type bituminous mixing plants, giving in detail the standard equipment that is used in these plants such as twin-shaft pugmills, driers, cold and hot elevators, horizontal vibrating screens, dust elevators, electric time locking devices, lime and naphtha batchers, charging hoppers and feeders, fuel oil pump and heater sets, and steam-jacketed flexible metal hose.—*Iowa Mfg. Co., Cedar Rapids, Iowa.*

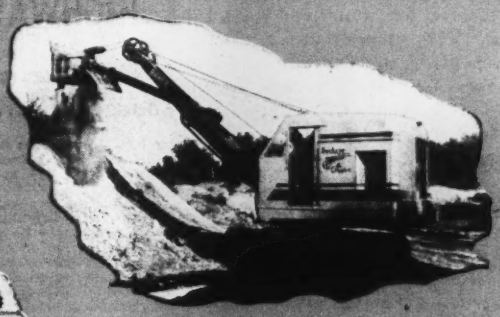
SPEEDING UP DOZER WORK—Application photos and diagrams featured in a new 4-page Tournadozer folder help explain how non-productive dozer time can be cut and how dozer work can be generally speeded up. All the new features designed and built into the high-speed, rubber-tired Tournadozer are explained. Basic specifications for this 180 hp., 15 m.p.h. tool are given.—*R. G. LeTourneau, Inc., Peoria, Ill.*

INDUSTRIAL LIGHTING EQUIPMENT—A new specification guide has been published for buyers, specifiers and sellers of industrial lighting equipment. The 36-page booklet contains specifications for 14 of the most commonly used incandescent and fluorescent lighting units. Specifications cover materials, shielding and brightness, efficiency, acceptance criteria, auxiliary control equipment, ballast temperatures, construction, reflection factor, photometric performance, national electric code requirements, etc. —*RLM Standards Institute, 326 W. Madison St., Chicago 6, Ill.*

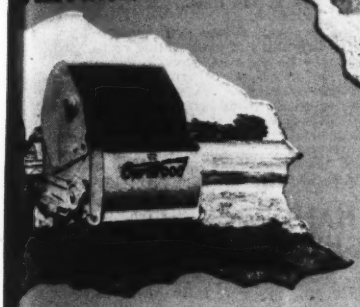
FOR THE LATEST IN *Cost Saving Equipment . . .*

SEE THE GarWood EXHIBIT AT THE ROAD SHOW

SPACE 3403
(SOUTH CONCOURSE)

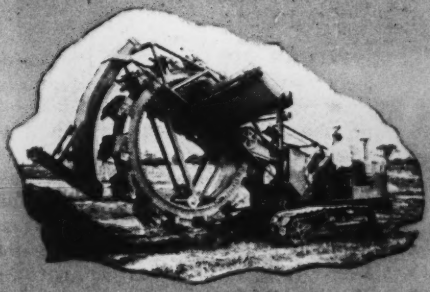


Buckeye Shovel with Mevac Power Control. Also available as Crane, Trench Hoe, Clamshell, Dragline, etc.



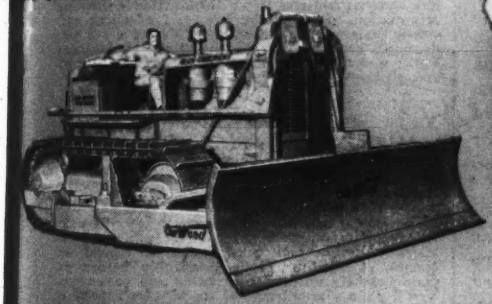
Wood 2-Wheel
and 5 cu. yd.)

Gar Wood, Buckeye and St. Paul construction equipment will occupy over 20,000 square feet of space at the American Road Builders Show in Chicago, July 16 to 24. Illustrated here are only a few representative units manufactured by Gar Wood Industries. See the complete line of the latest in Gar Wood equipment at the Show. The ideas you'll pick up will make it well worth your while.



Buckeye Ditchers, Wheel or boom types, from the largest to the smallest.

Wood Tipdozers and Doze-
on Allis-Chalmers Tractors.

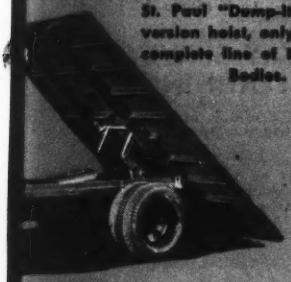


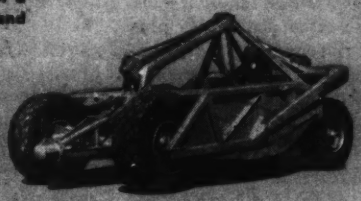
Gar Wood heavy duty dump bodies and hoists are now more rugged than ever.

St. Paul GAR WOOD GW INDUSTRIES Buckeye

THESE TRADE MARKS MEAN HIGHEST QUALITY

St. Paul "Dump-It", a conversion hoist, only one of a complete line of Hoists and Bodies.

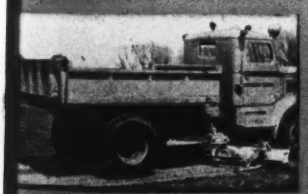




Gar Wood 4-Wheel Cable Scrapers (5 sizes, 7.6 to 28 cu. yd.)

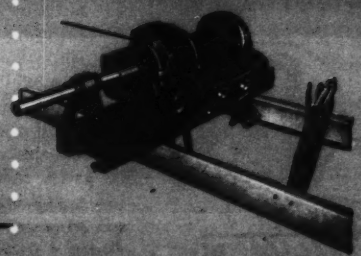
Buckeye Spreader for fast, controlled material spreading.

Gar Wood Utility Crane, the latest in a full line of truck cranes.



Ford Truck Patrol for economy
of speed in maintaining roads.

Gar Wood Load-Packer, for better public health and lower refuse collection costs.



Gar Wood Pool-Elite Winch saves cable, increases safety, eliminates delays. Other Winches from 9,000 to 75,000 lb. capacity.

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It is in the field of Irrigation that Layne Well Water Systems and Layne Vertical Turbine Pumps are most appreciated for their outstanding superiority of design, construction and quality. Of all places, the Irrigation field must have the utmost in dependability for long periods of continuous pumping. It is in this field that Layne water producing equipment is easily a 10 to 1 favorite in every case where ground water is used. Such leadership is highly complimentary to excellence of performance.

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SPEEDY SCRAPER—An interesting folder tells all about the Be-Ge hydraulically operated "Speedhaul" scraper, which is full carry with forced roll out ejection. It is claimed that it moves earth fast at low cost. It is designed for use with fast rubber-tired tractors. Finger-tip hydraulic controls instantly regulate the cut, lift, dump and spread operations. The operator has a clear view of the blade and can adjust cutting and spreading depth hydraulically, while a short turning radius makes it ideal for close work.—*Be-Ge Mfg. Co., Gilroy, Calif.*

WORKING CAPITAL—An attractive brochure tells the story of a typical case of how a manufacturing company was given a successful financing plan and had the needed additional funds placed at its disposal in 30 days. It is a success story that ought to be helpful to other manufacturers similarly situated. —*C. I. T. Corp., v Park Ave., New York 16, N. Y.*

POWER SHOVEL—All the improvements effected since V-J Day in the Buckeye Model 70 Clipper power shovel are shown in a new bulletin. One feature is an entirely new revolving frame designed for the tougher excavating problems and very sturdily made. The entire trench hoe attachment has been redesigned to give greater strength and longer life to all wearing parts.—*Findlay Division, Gar Wood Industries, Inc., Findlay, Ohio.*

PIPE CONVEYORS — A 39-page catalog covers Hapman patented pipe conveyors and accessories. Included are engineering drawings of typical systems for coal, sand, lead, chips and sludge handling. Pictures and sketches of drives, vibrator, sludge tanks, trench, pneumatrol and sealed pin chains plus capacity charts illustrate the pipe conveyor's adaptability and performance. —*Hapman Conveyors, Inc., 2405-12 West Nicholos Road, Detroit 21, Mich.*

ELECTRIC PLANT—An entirely new bulletin covering a 700-watt electric plant has been printed. It describes and illustrates this one-cylinder, air-cooled model and contains full engineering specifications. It outlines the many and diverse applications of the 700-watt size which is available in either AC or DC models. Small and compact, this portable Universal electric plant will provide reliable light and power service anywhere.—*Universal Motor Co., 413 Universal Drive, Oshkosh, Wis.*

BUILDING UTILITIES UNIT — Booklet tells of a variety of packaged units for house, apartment building, housing or hotel unit construction.

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HIGHWAY ENGINEER

√ Construction of Roads and Pavements

by T. R. Agg, Dean of Engineering, Iowa State College. 5th Edition, 483 pp., 6 x 9, 116 illus., $5.00
This practical manual shows you correct procedures for building and maintaining roads and pavements. It puts at your command authoritative information covering problems of highway engineering . . . the results of research by municipal and state bodies . . . approved methods of effectively filling requirements of road transportation. Every phase of road and pavement construction is covered—from the development of the present highway system and its management to the choice, cost and use of materials.

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by W. G. Harger and E. A. Bonney, Fourth Edition, 1720 pp., 5½ x 7, fully illus., $8.00
Two great volumes in one—containing information on the design, construction and maintenance of rural highways. The first section covers principles and practices—contains proven methods for doing jobs more quickly and accurately. The second section covers Field and Office Data—trouble-shooting information, right on the job . . . excellent reference material for the office. This set gives you thorough coverage of the essentials of highway work: general economics, location, grading, drainage, pavements, etc.

√ PRINCIPLES OF HIGHWAY ENGINEERING

by C. C. Wiley, Associate Professor of Highway Engineering, Univ. of Ill., Second Edition, 560 pp., 6 x 9, fully illus., $4.50
A concise explanation of highway engineering principles and practice. It presents the procedures of highway design and construction in logical sequence. Covers materials thoroughly before explaining their utilization in roads and pavements. You'll get a clear picture of the broader aspects of design, finance and operation. Gives you facts on bituminous and non-bituminous materials, gravel and macadam roads, resurfacing, repairs and widening, survey plans, etc.

√ HIGHWAY SURVEY AND PLANNING

by T. F. Hickerson, Professor of E. E., Univ of N. C., Second Edition 422 pp., 5½ x 8, illus., $4.00
Here's a reference manual on highway design. It presents and clarifies all problems of design, including methods of location and planning, curves and earthwork, widening of pavements and banking. The economic and aesthetic advantages of easement spirals are fully treated. It contains a variety of original tables to facilitate the layout of these curves by the field engineer.

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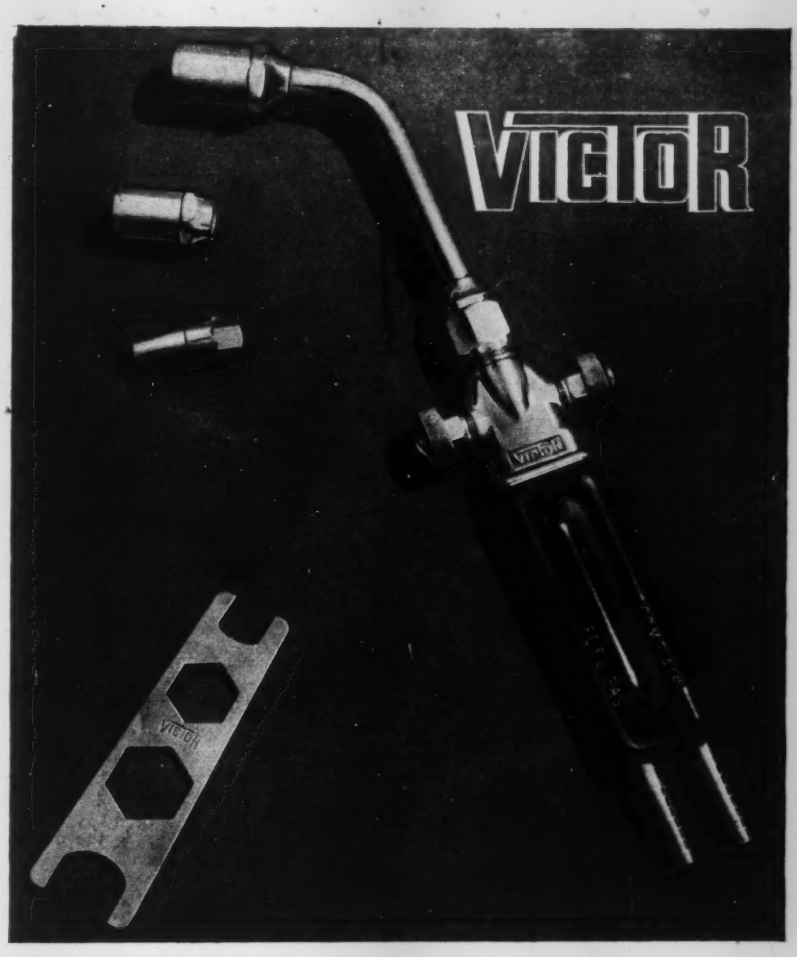
CONCRETE CUTTER — (leaflet). Equipped with diamond saw blade, portable machine is mounted on wheels and powered by 6-hp. engine, weighs 395 lb. Strat-edge machine cuts concrete from depths of from 1 to 3 in. Manufacturer recommends it in operations of tearing up and replacing sections of floor surfaces in buildings. Simple gage controls depth of cut. Blade is water cooled. —*Backlin Products Corp., 461 Washington St., Burlington, Wis.*

METAL MOULDING—(68-p. booklet). Various sizes and types of stainless steel, aluminum, bronze and metal-covered wood mouldings. Also line of complementary tools including cutters, scribers, seam rollers, mitre boxes, hacksaws, tin snips. Included are snap-on mouldings, Tee-sections, angles, channels, flat-strips, oval tops, tubing and slip-in mouldings. Also counter-facings, coves, and edgings.—*Loxit Moulding Co., 1217 W. Washington Blvd., Chicago 7, Ill.*

STAINLESS PLATES—A 32-page booklet illustrated with photographs, tables and charts tells of stainless plates (solid and clad) and their fabrication. The tables and charts show available sizes, thicknesses and weights. Shop work, cutting, machining, forming welding and annealing are also described. —*Allegheny Ludlum Steel Corp., Pittsburgh 22, Pa.*

COMPRESSOR AIR FILTERS —A 2-color, 8-page bulletin describes dry-type intake air filters for all types of air compressors, diesel and gas engines, blowers, motors and generators. The various filters described include silencer models, regular dry-type and breather filters. They range in size from 6 CFM to 8000 CFM in single units. All filters feature the original radial finned insert design.—*Dollinger Corp., Rochester 3, N. Y.*

HOSE FITTINGS—A new catalog section on hose fittings gives recommendations for attaching couplings to



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● The Victor Model 3401 Torch, with conveniently fitting plastic handle can utilize any fuel gas either with compressed air or with oxygen and requires merely the proper tip in the desirable size for the job. Write for details or, better yet— ask your nearest Victor distributor to show you this very desirable and compact and useful torch.

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hose since proper attachments increase the service life of the product, and insure maximum safety. There is also a table showing the various couplings recommended for different types of hose, and a detailed discussion of coupling threads and their functions. Each fitting is pictured and described, with sizes available listed.—*The B. F. Goodrich Co., Akron, Ohio.*

TRUCK MIXER—A new bulletin explains the Rex Patented Hi-Lo visible mixing action, the new Rex water nozzle for proper placement of mixing water, new faster charging and discharging, Rex 3-point drum suspension and the "cushioning" chain drum drive, accurate water system with booster pump, Rex twin clutch transmission, and the Rex discharge system with photos illustrating its many spout arrangements.—*Chain Belt Co., 1600 W. Bruce St., Milwaukee, Wis.*

ROOF VENTILATOR—Booklet tells about "Iron Lung" which it is claimed "makes buildings breathe better". It is a roof ventilator engineered for power operation. It quickly exhausts large volumes of polluted air from industrial buildings bringing in fresh air to maintain the health and energy of workers. The clear, open throat of "Iron Lung" permits high velocity discharge which exhausts the toxic air as high as 30 ft. above the roof. Cost of installation is said to be low. Three-price units are easy to assemble and install on any roof.—*Powermatic Ventilator Co., 4019 Prospect Ave., Cleveland 3, Ohio*

CRUSHING AND SCREENING PLANT—Catalog features a 2-unit portable crushing and screening plant. Pictures show the 1-man, 1-engine operation built around the New Holland Model 3030 Double Impeller Breaker. A coupon offers complete details and a showing of "The New Stone Age," sound movie in natural color.—*New Holland Mfg. Co., Mountville, Pa.*

AIR ENTRAINMENT METER—A folder describes a 20-lb. concrete air entrainment meter which has a direct reading scale calibrated in percent of air content, pressure gage in pounds. All parts are precision-made for accuracy and built for rugged use either in the field or laboratory.—*Steffing Mfg. and Supply Co., 1735-37 Blake St., Denver, Colo.*

SPIRAL CONVEYOR—48-page catalog covers the application of a spiral conveyor, how to specify, horsepower forms to new industrial standard dimenformulas, etc. All the equipment consions.—*The Jeffrey Mfg. Co., Columbus 16, Ohio.*

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equipment for all water supplies—

Iron is objectionable! The U. S. Public Health Service Drinking Water Standards state that the iron (Fe) and manganese (Mn) content together shall not exceed 0.3 ppm for general household use.

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IDEAL for stairs, ladders and fire escapes, because the square-edge, uniformly spaced steel bars of Hendrick Mitco construction provide a non-slipping, level walking surface, and have no angle irons, bolts or rivets to collect dirt and refuse, or obstruct light and ventilation.

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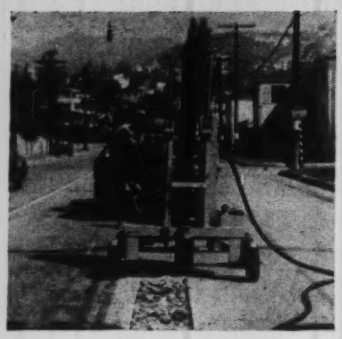

CUT LABOR COSTS!

One MAN riding a MIGHTY MIDGET breaks 100 linear feet per hour of 18" wide trench opening in 6" concrete pavement and cuts a beautifully straight line. MIDGET is supplied with air from 105 C.F.M. compressor. Write for complete information and your dealer's name.

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• KEEP YOUR CONVEYOR BELTS GOING

FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

• Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.

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FLEXCO H D BELT FASTENERS

Sold by supply houses everywhere

Men and Jobs

Warren Neel, Atlanta, deputy director and state highway engineer for the Georgia highway department, has been appointed director to succeed John Beasley, resigned. Mr. Neel has been with the department more than 20 years. A graduate of Georgia Tech, 1901, he joined the department in 1916 and remained until 1930 when he became director for Asphalt Services, Inc. He later was a road machinery manufacturers agent, was WPA engineer for Dekalb and Fulton counties and in 1937 rejoined the highway department as director of post roads. He became state highway engineer in 1940 and the following year chief engineer for Cooper & Cooper in the construction of the air fields in Albany, Ga. In July, 1941 he became construction manager of Pan-American Airways for the western division, including Mexico and South American countries. He became engineer consultant for the entire system. Later he was chief engineer for Tucker & Tucker and then was associated with Robert & Company. In 1947 Mr. Neel rejoined the Georgia State Highway Department as engineer and deputy director.

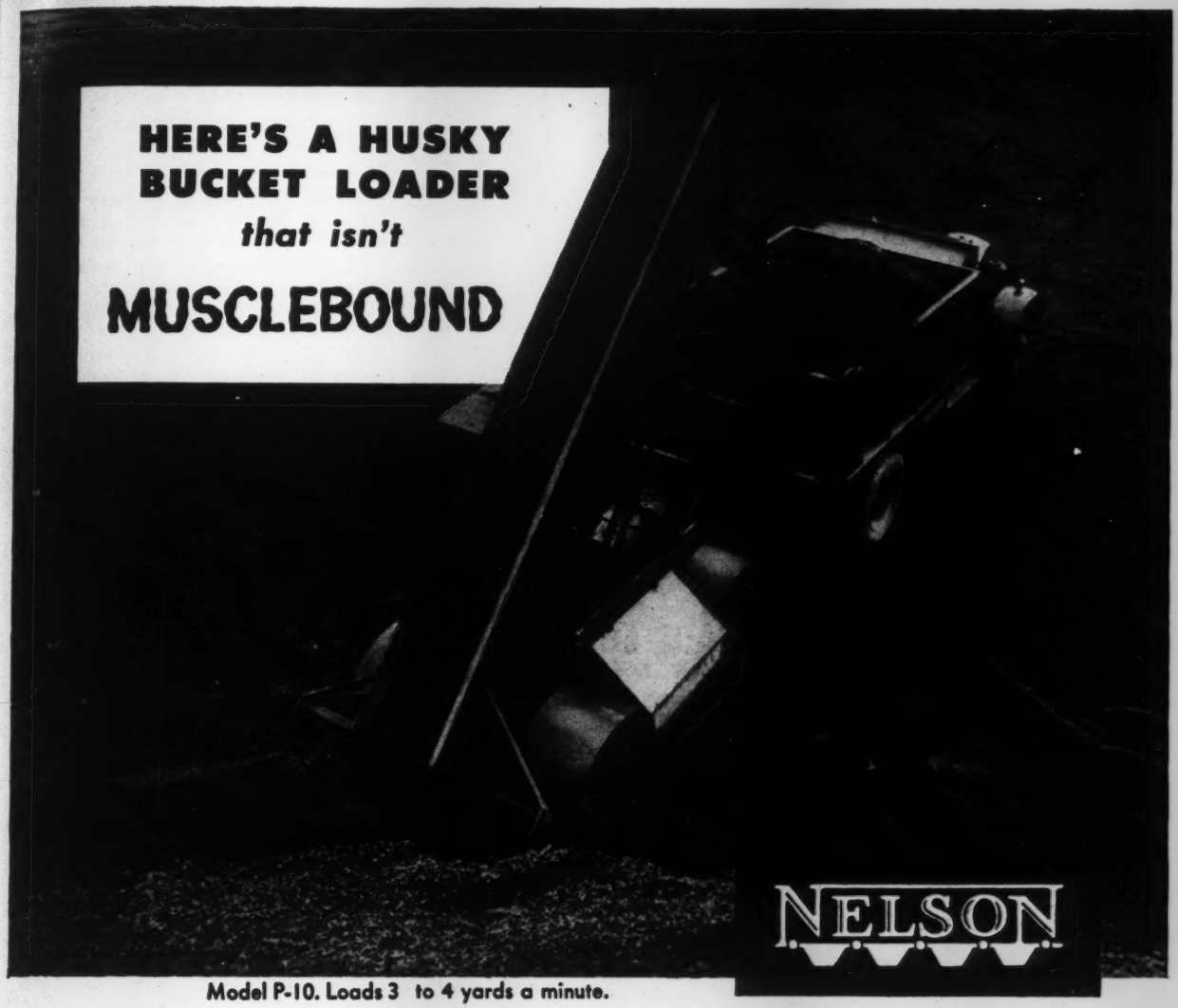
Charles Sargent of Moscow, Ida., a University of Idaho graduate with nine years of experience in highway engineering, has been named assistant professor of civil engineering at the University of Idaho.

Norman D. Kenney has joined the staff of G. Douglas Andrews Associates, engineering consultants, 212 Washington Ave., Towson, Md.

W. B. Jennings newly appointed city engineer for Garden City, Kan., served for 18 years as a resident engineer for the Kansas State Highway Department.

Neal Harr, city engineer of McPherson, Kan., has resigned to become city manager of Belleville, Kan. He was city engineer at McPherson for seven years.

K. C. Gaynor has become city engineer of Sioux City, Ia., succeeding **Leon Winter,** resigned.



Model P-10. Loads 3 to 4 yards a minute.

A NELSON HEAVY-DUTY is a *powerful* loader with *flexibility* and *ease-of-handling* that is real news in a machine so solidly built for rough steady going.

Working in yard or pit, scooping up windrows on highways, biting into firm materials in stripping and mining, a Nelson loader—for all its brawn—responds sensitively and surely to operator's touch.

Toothed spiral feeder that *picks before it shovels* . . . hydraulic hoist . . . Timken bearings . . . Twin Disc clutches . . . hardened bucket chains . . . four-speed transmission . . . quick, easy steering. With features like these, the big Nelson combines *stamina* and *ease-of-handling* to a new high degree. It's rugged without being musclebound. Use a Nelson for quicker, more economical loading. Available with wheel or crawler mounting.

Before you buy, see a Nelson *perform*. Write for details and prices.

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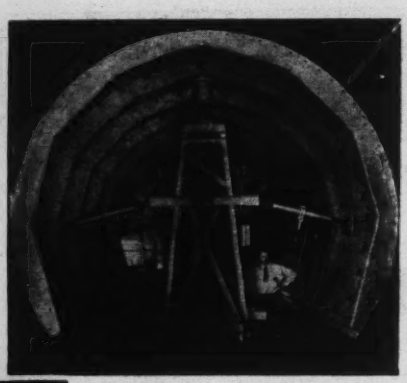
Truck Loaders Since 1917

MAYO TUNNEL & MINE EQUIPMENT



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for Tunnels, Sewers Conduits and Walls

TUNNEL SHIELDS
Complete with Hydraulic Equipment

AIR LOCKS
Write for Bulletin #12.

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New LIGHTWEIGHT ELECTRIC PLANT

5000 WATTS D.C.

Weighs only 315 lbs.!

Model 5CK-115M, 5,000 watts, 115 volts D.C.

Use fast-working electrical tools on any construction or maintenance job with this high capacity, portable, compact electric plant. Equipped with four-receptacle box for direct plug-in of tools or lights. Available with carrying frame, or dolly-mounted. Powered by Onan 10 HP, two-cylinder, 4-cycle, air-cooled engine. Shipped complete . . . ready to go!

NEW ONAN "CK" ELECTRIC PLANTS are available in 5000 watts D.C., 115 and 230 volts; 2000 and 3000 watts A.C. in all standard voltages.
COMPLETE ELECTRIC PLANT LINE INCLUDES: A.C.—350 to 35,000 watts in all standard voltages and frequencies. D.C.—600 to 15,000 watts, 115 and 230 volts. Battery Chargers—500 to 6,000 watts, 6, 12, 24, 32 and 115 volts.
ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5½ HP. IB: 1-cylinder, 3¼ HP.

Onan PRODUCTS

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5378 Royalston Ave., Minneapolis 5, Minn.

ONAN ELECTRIC PLANTS

Harvey H. Plank, formerly vice-president and assistant general manager of the Delaware Power and Light Co. has been named vice-president in charge of engineering and operations.

Charles W. Wilson, at Palnur, Alaska, is territorial conservationist for the Soil Conservation Service. For the last 13 years he has been engaged in soil conservation work in various capacities and in various sections of the West, latterly as head of the flood control section of the Water Conservation Division of the service, for California, Nevada, Oregon, Washington, and Idaho, with headquarters in Portland, Ore.

Worth N. Yoder, former city manager for Tipton, Ind., has become city manager in Sturgis, Mich., succeeding Raymond Greenberg. Yoder, a graduate of Purdue University, was formerly with the W. F. Schulz Co., War Department consulting engineers, in Memphis, Tenn., and with the Indiana Service Corp., Fort Wayne, Ind.

Charles N. Campbell, assistant valuation engineer for the Southern Pacific Lines at Houston, Tex., since 1920, has retired. He is a graduate in engineering from the University of Texas and has been with the Southern Pacific Lines since 1905. **William F. Sanders,** assistant engineer for the Southern Pacific, succeeds Mr. Campbell.

Pfuhl and Shideler is a newly-formed firm of consulting structural engineers with offices in suite 814 Finance Building, Kansas City, Mo. **Erwin Pfuhl,** a consulting structural engineer, and **H. K. Shideler,** a former structural engineer for the Portland Cement Association are members of the firm.

Chester L. Dalzell, former project engineer in the New York office of the General Foods Corporation, has been named assistant chief engineer for the Central Soya Company of Decatur, Ind.

Richard Nicholson, who was associated with the Consoer, Townsend & Associates engineering firm of Chicago, has been appointed city engineer of South Milwaukee, Wis., on a temporary basis.

H. W. Worstell is city manager and engineer of Nevada, Ia.

J. J. Corbett, engineer of construction for Missouri, has completed 25 years' service with the state highways.

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1. Now any of your drawings can be reproduced in black, blue, red, or sepia lines on white or tinted paper. Thus, you can "color code" your prints . . . speed routing . . . eliminate errors.

2. You can always match the job at hand. For example: If grease and grime abound in the shop you can practically eliminate replacements by ordering Ozaplastic prints. These durable prints are oilproof, waterproof—can be cleaned in seconds with a damp cloth.

3. You can improve on your best drawing by ordering Ozacloth or Ozalith translucent "masters." These new materials increase the line densities of your original . . . are plastic-coated . . . oilproof, waterproof . . . turn out Ozalid prints of maximum visual density.

4. New Ozalid Stripfilm—a transparent, adhesive-back material—can be used to transfer title blocks, sections, etc., from one drawing or master copy to another.

Using Ozalid foils, you can combine on *one* print the details of separate, but related, drawings. And new Ozachrome even allows you to make transparent overlays in full color.

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And speed? Standard Ozalid prints are produced in 25 seconds—or less! Each a positive copy produced directly from your original drawing.

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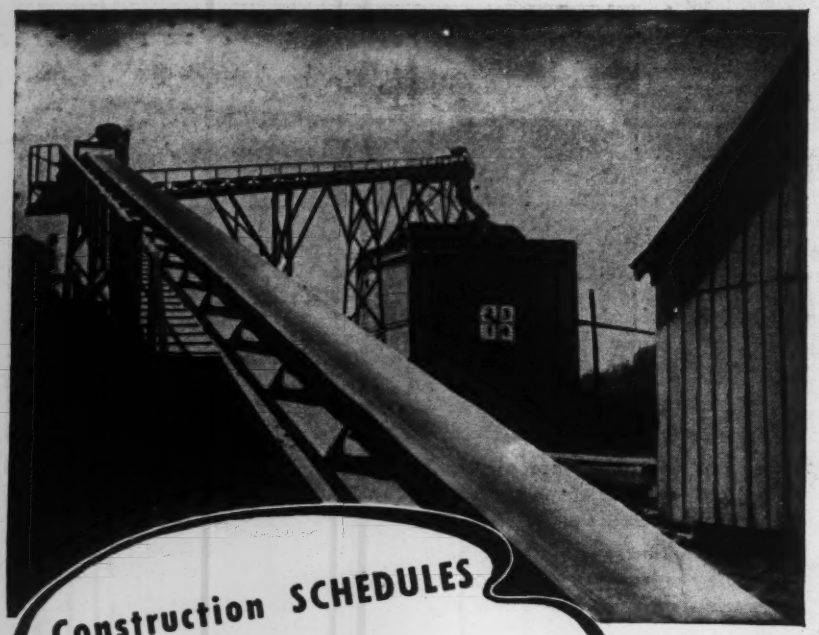

Manhattan Conveyor Belts Help Meet Your Schedules

Here, two 20", 4-ply Manhattan Conveyor Belts are feeding a continuous stream of sand and gravel to a modern concrete mixing plant. An interruption due to belt failure would be costly — men and machines would be delayed. However, experience has taught the contractor owner of this plant to rely on Manhattan quality in workmanship and materials.

Manhattan Rubber engineers are known as the conveyor belting pioneers. Every Manhattan Conveyor Belt is mildew-proofed. Moisture cannot cause ply deterioration. Covers resist abrasion and withstand all weather conditions. Strength Members withstand the tension of heavy, constant operation. Flexibility to "relax" in the troughing idlers, and resiliency to stand shock loading, also contribute to long life.

A Manhattan Conveyor Belting Engineer is at your call. Rely on him for advice on any materials handling problem.

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Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION PASSAIC, NEW JERSEY

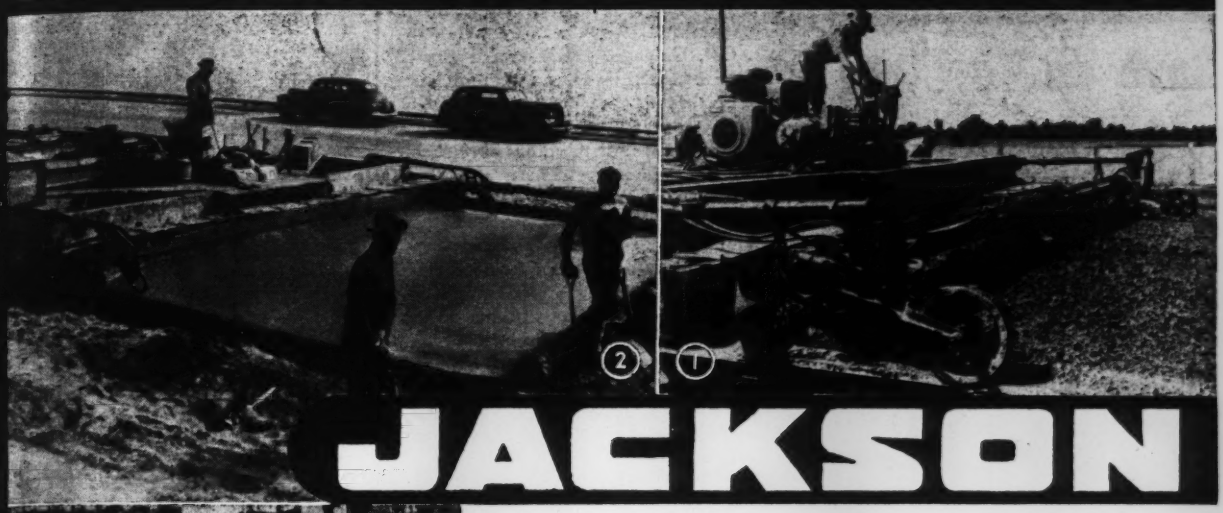
Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

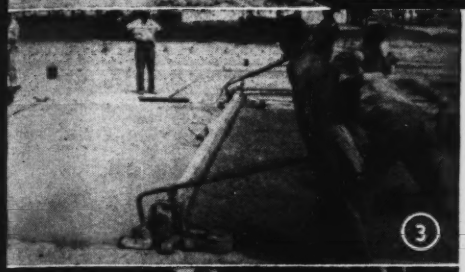
Sales—R. V. Bradley is special engine sales representative of the CATERPILLAR TRACTOR CO., Peoria, Ill. J. M. Abbey succeeds him in contacting distributors and dealers in Minneapolis, Minn., and central Canada . . . A Mid-Atlantic region, headquarters, Philadelphia, Pa., for the ALLIS-CHALMERS general division field organization has been created under William Arthur, and Frank Freyler succeeds Arthur as Philadelphia district office manager, and he, in turn, is succeeded by W. F. Daly as manager of the Cincinnati office . . . To handle the sale of Yale automotive locks and specialty hardware Al Vos of Kansas City, Mo., has been appointed manager of the Detroit office of THE YALE & TOWNE MFG. CO. . . . THE JAEGER MACHINE CO., Columbus, Ohio, has named John A. Schultz manager of southern sales and service at 235-38 American Life Bldg., Birmingham, Ala. . . . John W. Bishop is sales representative of the MARION POWER SHOVEL CO. in southern Indiana, western Kentucky and southeastern Ill. SHAFFER & CO., Brazil, Ind., is distributor in that area . . . Fred C. Foy has become vice-president and manager of sales, central staff of KOPPERS CO., INC. . . . F. Kelly Dusenberry is sales manager of ROBISON MACHINERY CO., Salt Lake City, Utah . . . Robt. B. Parker has been appointed manager of sales, Washington special accounts office, CARNEGIE-ILLINOIS STEEL CORP. succeeding L. R. Knapp, retiring . . . Harry R. Powers has been appointed eastern sales manager for R. C. LETOURNEAU, INC., succeeding E. M. Ferguson, resigned . . . Carl W. Meininger will be in charge of aluminum development and sales for STACEY BROTHERS GAS CONST. CO., Cincinnati, Ohio.

Distributors—PRAIRIE EQUIPMENT & RADIATOR, LTD., Winnipeg, Man., has been appointed Manitoba distributor for R. G. LETOURNEAU, INC., Peoria, Ill. . . . L. D. Litsey is Chicago area representative for worm gear speed reducers for the DE LAVAL STEAM TURBINE CO., Trenton, N. J. . . . C. W. Scholvin is district representative for the LAPLANTE-CHOATE MFG. CO., INC., Cedar Rapids, Iowa, in New York, Pennsylvania, Maine, Maryland, New Hampshire, Connecticut and eastern Canada . . .

*SEE THEM AT THE ROAD SHOW!



JACKSON



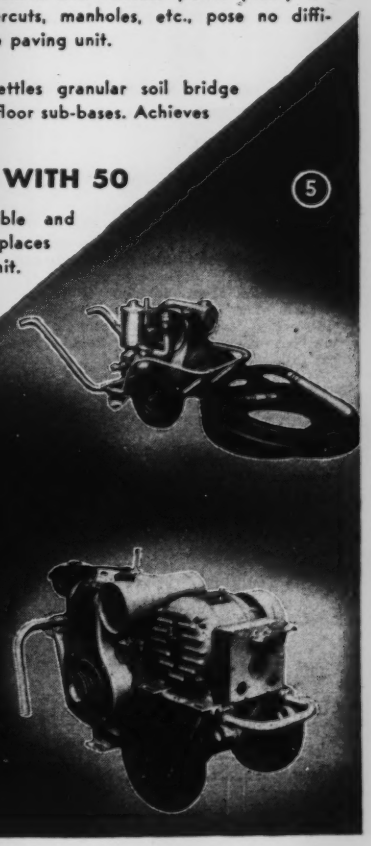
1. **PAVING TUBE:** Provides thorough compaction of stiff, economical concrete full width of the slab; faster finisher progress and a better job. Operated by finisher operator. Quickly adjustable for slab widths.

2. **SIDE FORM VIBRATOR:** Works equally well when mounted ahead of finisher screed or in the rear of spreader. Controlled by finisher operator — no other labor required. Vibrators will not penetrate through concrete to subgrade. May also be had as part of Paving Tube.

3. **MUNICIPAL PAVING UNIT:** (Consisting of electrically vibrated, manually guided paving machine and reliable power plant) is a tremendous producer. Crowns, undercuts, manholes, etc., pose no difficulties for this remarkable, inexpensive paving unit.

4. **SOIL COMPACTOR:** Pre-settles granular soil bridge approaches, similar fills and concrete floor sub-bases. Achieves up to 95% density in single pass.

5. **HYDRAULIC VIBRATOR WITH 50 FT. REACH:** Highly dependable and efficient. Reaches hard-to-get-at places with minimum moves of power unit.



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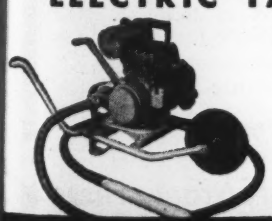

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you can save on hardware with Lank-Teco. Design incorporates features such as the lap chord splice which reduces the number of members to a minimum, and also influences the amount of the hardware needed. The great saving in lumber (about ½) and labor costs is worth considering also.

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of the Lank-Teco superiority: under test, a 50' Lank-Teco Truss span was loaded to full design load of about 25,000 lbs., for 7 months, which was double the designed for time of loading. Despite the long loading period, results were: deflection only ½ that of similar span flat-top truss also tested. The Lank-Teco truss was overloaded to failure after 7 months, and carried almost 2½ times design load at failure!

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Chas. K. McArthur will represent THE DORR CO. in Washington, Oregon and Idaho, his office being in the Lloyd Bldg., Seattle 1, Wash. . . . THE BARCO MFG. CO., Chicago, producers of gasoline hammers, drillers and rammers, has announced that the territory of the KOONTZ EQUIPMENT CORP. of Pittsburgh, exclusive distributor of Barco gasoline hammers in western Pennsylvania for many years, has been extended to include northeastern Ohio and the Cleveland area. Cincinnati's HIGHWAY EQUIPMENT CO. has been appointed distributor in southwestern Ohio and the sections of Kentucky and Indiana adjacent to Cincinnati. The CONSTRUCTION MACHINERY AND SUPPLY CO. of Toledo will be distributor in northwestern Ohio. FLESCH-MILLER TRACTOR CO. of Lawrence, Ind., has been named distributor in that state.

Personalities—Kenneth A. Helmly is manager of the Columbia, S. C., branch of the SOUTHERN STATES IRON ROOFING CO. . . . W. E. Jubien is Washington representative of BARIUM STEEL CORP., New York . . . R. W. Dickson is manager of the CAPITOLAIRE division of the U. S. RADIATOR CORP. A. J. Reebel is acting manager of the Cleveland branch and A. X. Bergeron acting manager of the St. Louis branch . . . Danforth K. Heifle is chief field engineer for R. G. LETOURNEAU, INC. . . . P. F. Bauer is manager of the central region of ALLIS-CHALMERS general machinery division at Cleveland, Ohio . . . New vice-presidents of the GORMAN-RUPP CO., Mansfield, Ohio, are: Warren E. Rupp, Walter O. Buehler and Kenneth H. Cadigan . . . Harlowe Hardinge, president of HARDINGE CO., INC., heavy machinery manufacturer, has just returned from an 11,000-mile trip contacting plant operators in various parts of Canada and the U. S. . . . Gilfray Ward has been named vice-president of the KELLOGG division of the AMERICAN BRAKE SHOE CO. at Oakland, Calif. . . . John C. Painter is now district representative of THE GALION IRON WORKS & MFG. CO. in New York, Pennsylvania and Maryland . . . Gerald Bogner is engineer and representative for KENNAMETAL, INC., of Latrobe, Pa., working out of New York office at 6 West Broadway. Delmar Baker is engineer and representative at the Chicago office, 9 No. Jefferson Street . . . Election of Leonard C. Barr, Maurice A. Enright, and William J. Kane as vice-presidents of MORTON-GREGORY CORP., Toledo, Ohio, has been announced by Henry J. Morton of Detroit, president . . . Howard Marston, sales and service engineer at the Boston branch of MINNEAPOLIS-HONEYWELL REGULATOR CO., has been appointed industrial manager of the BROWN division.

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